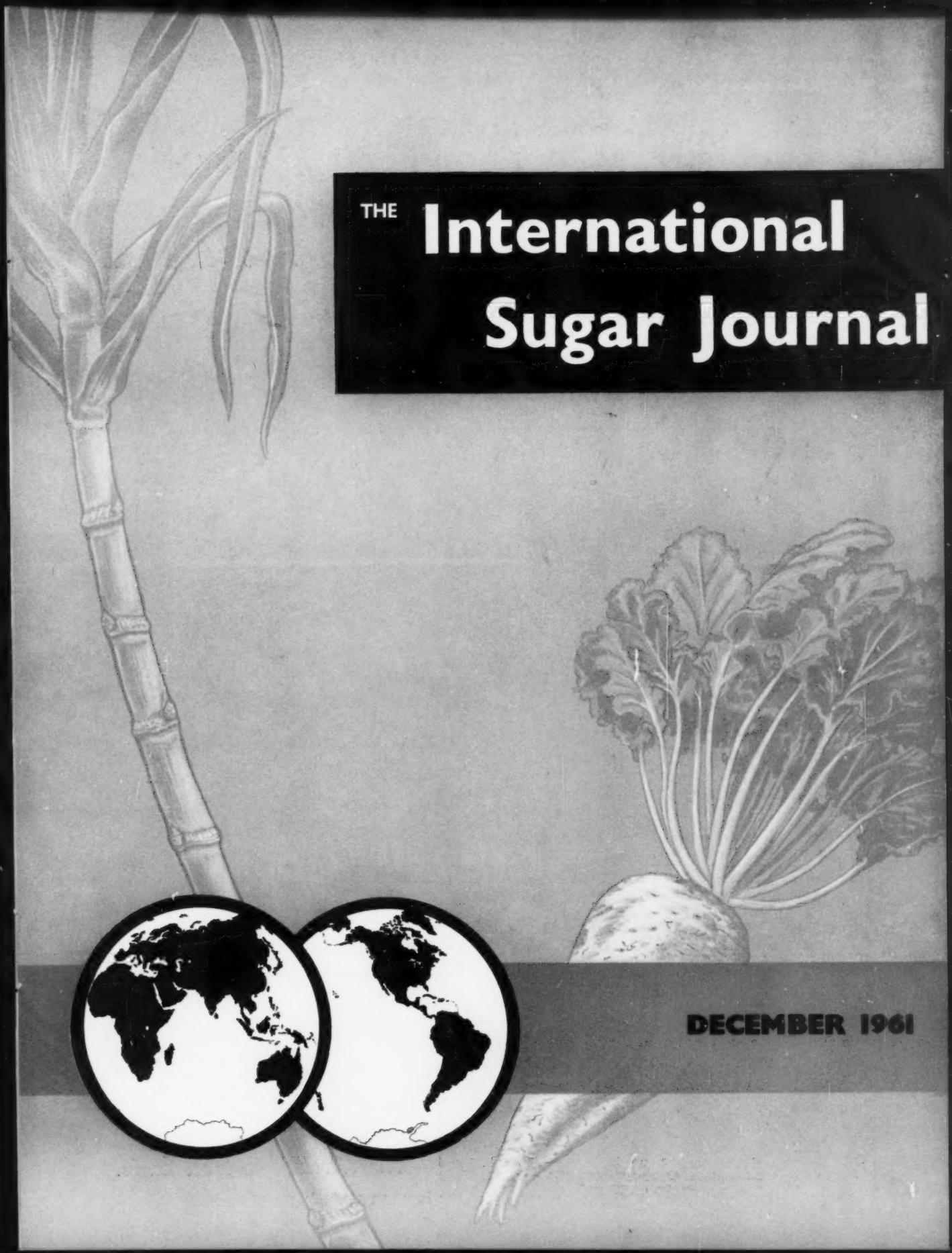
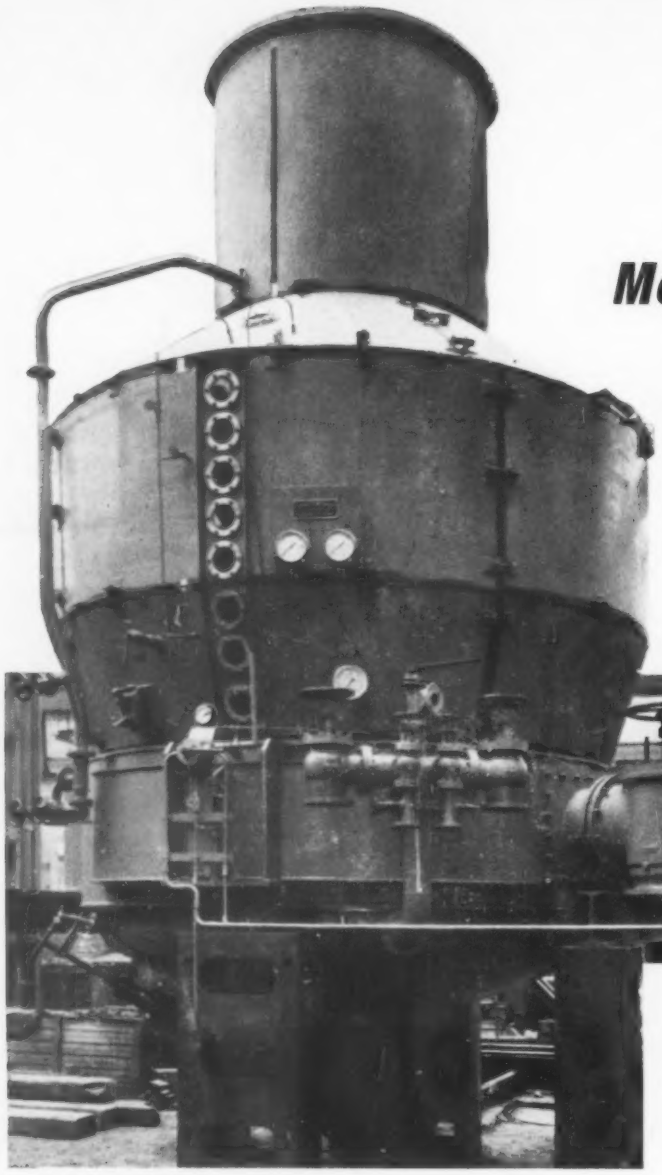


THE International Sugar Journal

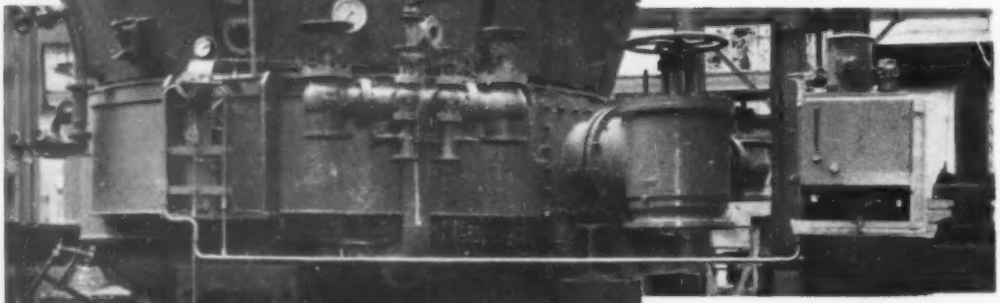
DECEMBER 1961



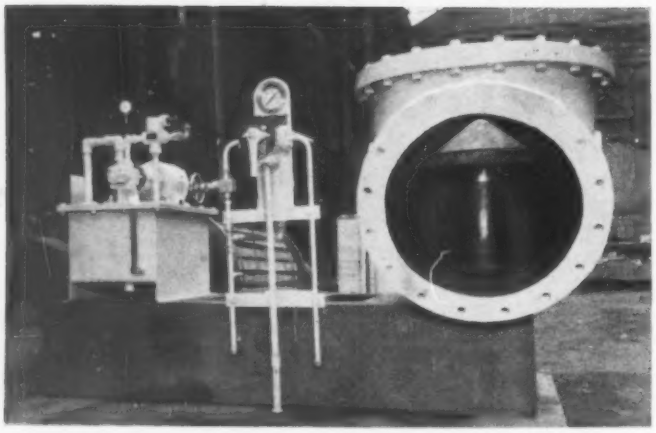
BLAIRS

Modern Vacuum Pans
for
This Modern Age

Our illustration shows one of our Low head type Calandria Vacuum Pans which has a strike capacity of 1300 cubic feet and a heating surface of 2100 square feet. It is fitted with all usual accessories including a hydraulically operated Discharge Valve which is shown in greater detail below.



This illustration shows the hydraulically operated Discharge Valve fitted to our Calandria Vacuum Pans. These valves can also be fitted to existing Pans.



Sole Makers of
MULTIPLEX FILM EVAPORATORS

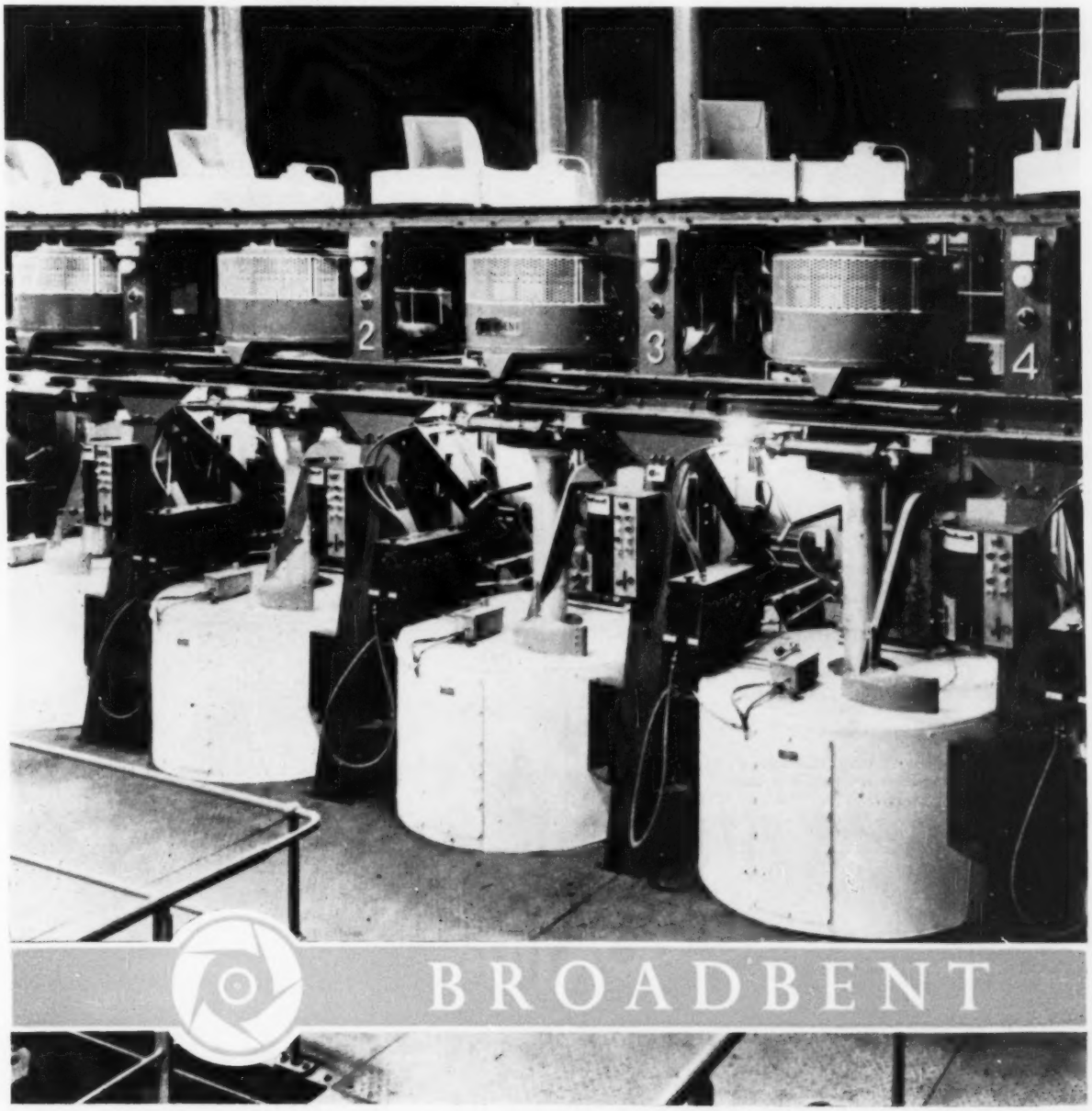
BLAIRS
LIMITED

A MEMBER OF
THE MIRRLEES WATSON GROUP.

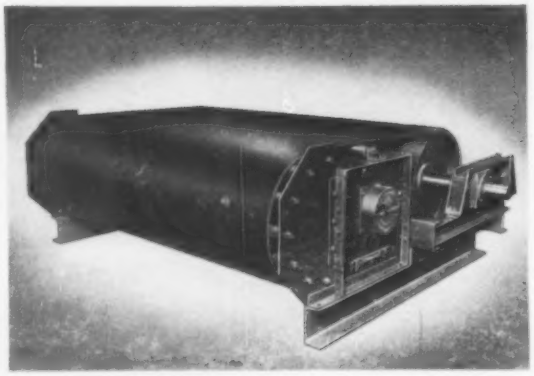
Part of a battery of five 48″ × 30″ × 1200 R.P.M. fully automatic centrifugals installed at the Mon Désert-Alma factory, Mauritius, for the 1961 campaign, to cure all A and B massecuites. Two identical machines were also installed at the Belle Vue factory and two further machines have been ordered for the 1962 campaign.

THOMAS BROADBENT & SONS LTD.
CENTRAL IRONWORKS, HUDDERSFIELD, ENGLAND.
TELEPHONE: 5520/5 TELEGRAMS 'BROADBENT' HUDDERSFIELD

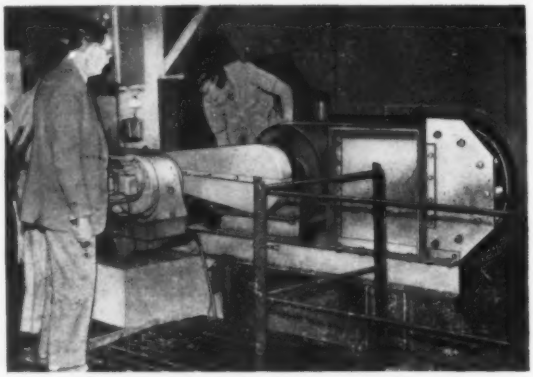
Photograph by courtesy of
Mon Désert-Alma Ltd., St. Pierre, Mauritius.



MAGNETIC CONVEYOR HEAD



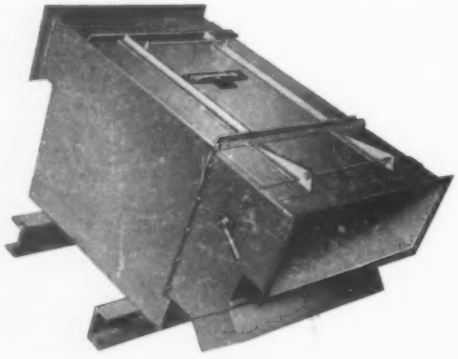
Boxmag patent MH. 2484. Conveyor Head built into an 84" wide short belt conveyor, photographed prior to despatch. The machine is designed for installation, as shown on the adjacent illustration.



Boxmag patent MH. 2484 installed in the chute between a sugar cane carrier and crusher, at a factory in Mauritius. It is designed to remove tramp metal automatically and continuously without an operator's attention. (write for leaflet 62/2).

MAGNETIC SEPARATORS
PROTECT
MACHINERY AND PRODUCTS

(Write for further details)



Boxmag Superflux Magnetic Chute for removal of ferrous contamination from refined sugar to decontaminate the product.

A Boxmag Unimajor block type Permanent Magnet. One of the many types of separators suitable for general applications in sugar factories. (write for details of full range).

BOXMAG

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Central 5391

Telegrams :
Boxmag Birmingham

ELECTROMAGNETS LTD

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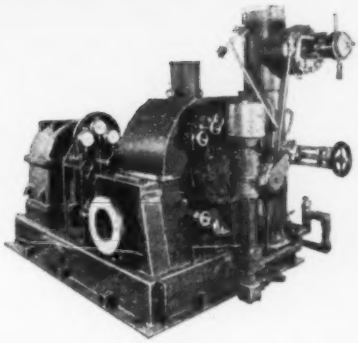
Mirrlees' STEAM TURBINES for the Sugar Factory

MIRRLEES STEAM TURBINES COVER A WIDE RANGE OF APPLICATIONS IN THE SUGAR FACTORY

FROM

CANE KNIVES DRIVE

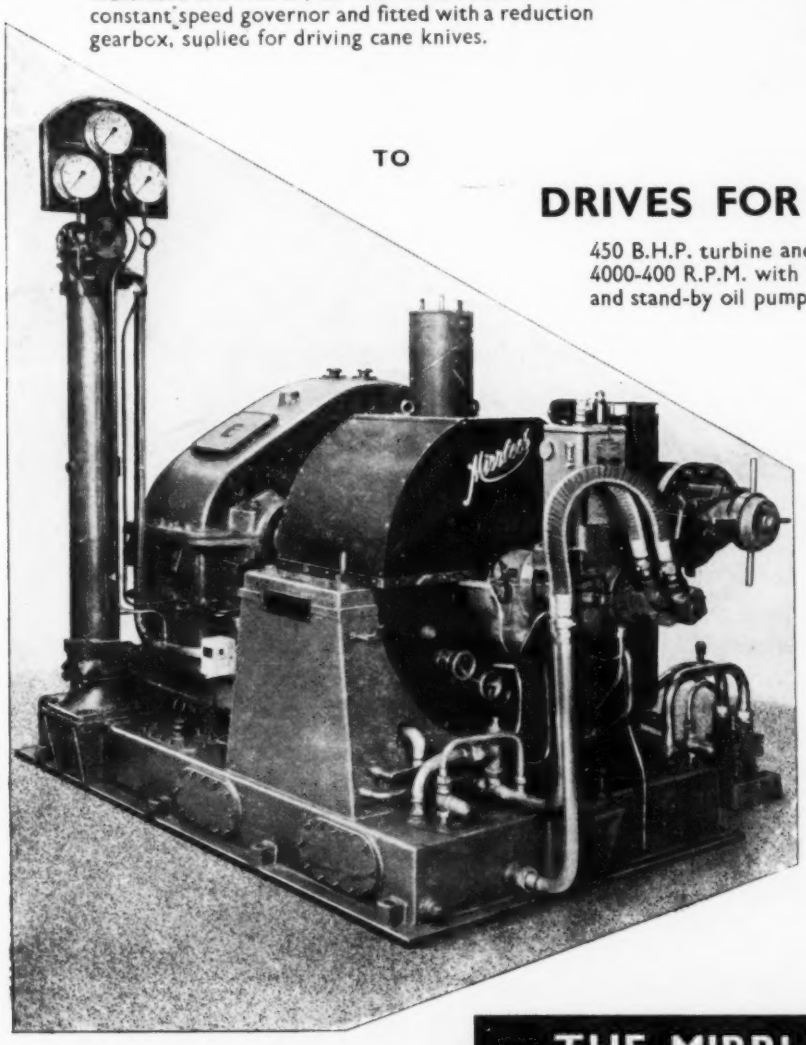


Illustrated is a F.E.A.7, 350-400 B.H.P. turbine with constant speed governor and fitted with a reduction gearbox, supplied for driving cane knives.

TO

DRIVES FOR SUGAR MILLS

450 B.H.P. turbine and single reduction gear box 4000-400 R.P.M. with variable speed governor and stand-by oil pump.



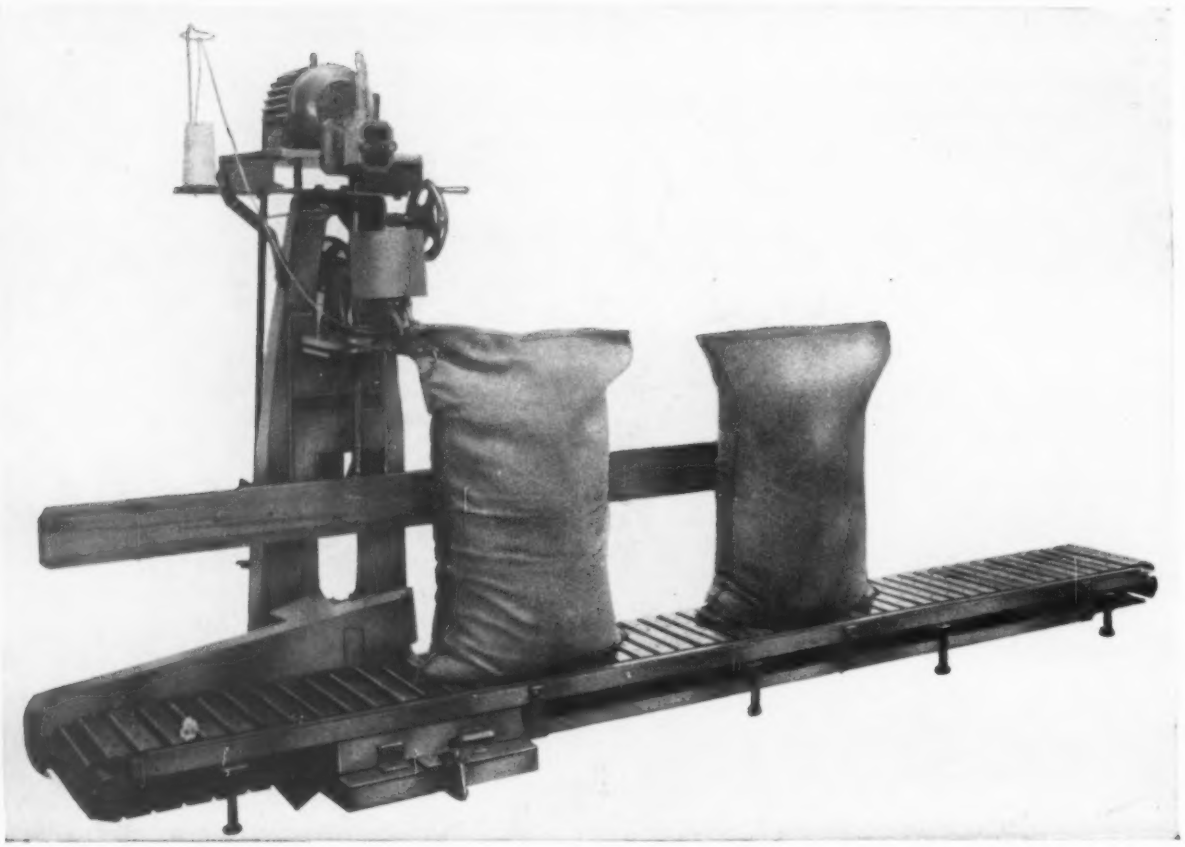
MAY ALSO BE USED AS A LOW COST REPLACEMENT FOR EXISTING PRIME MOVERS WHERE INCREASED MILLING CAPACITY IS REQUIRED

THE MIRRLEES WATSON COMPANY LIMITED
GLASGOW SCOTLAND

The 'Super' Universal Sack Closing Machine

MODEL NO. 5B

Fitted with 10 or 12 ft. Conveyor and Special Clutch Drive



This machine is fitted with a conveyor 10 or 12 ft. overall and a Special Clutch Drive which allows the conveyor to be run independently of the sewing head.

Jute, Hessian, Paper Lines Hessian, Cotton and Paper Sacks weighing from 50 to 325 lbs. can be sewn on this machine.

Machines can be seen working by appointment.

Power required 2 h.p. *Shipping weight : 14 cwts.*

Manufactured in Great Britain by :

The Sack Filling & Sewing Machine Syndicate Limited

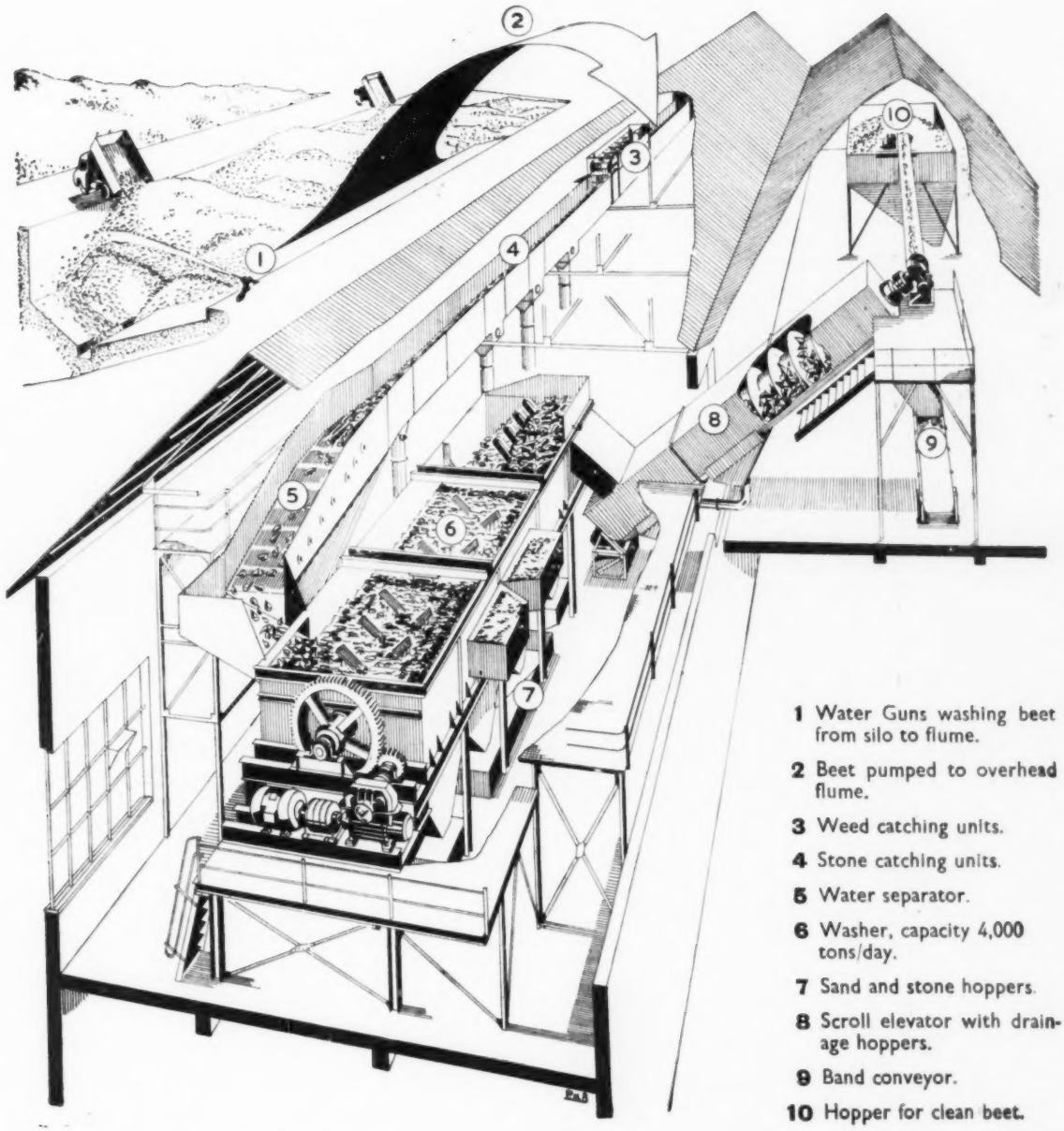
(Timewell's Patent)

TIMEWELL WORKS . LOCKFIELD AVENUE . BRIMSDOWN . ENFIELD . MIDDX.

Telephone : HOWARD 1188 *Telegrams :* FECIT, ENFIELD

BEET WASHING PLANT

AS SUPPLIED TO THE BRITISH SUGAR CORPORATION LTD



1 Water Guns washing beet from silo to flume.

2 Beet pumped to overhead flume.

3 Weed catching units.

4 Stone catching units.

5 Water separator.

6 Washer, capacity 4,000 tons/day.

7 Sand and stone hoppers.

8 Scroll elevator with drainage hoppers.

9 Band conveyor.

10 Hopper for clean beet.

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Ipswich 56161 (5 lines)

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Under a single comprehensive contract, with undivided responsibility, 'ENGLISH ELECTRIC' undertake complete factory electrification.

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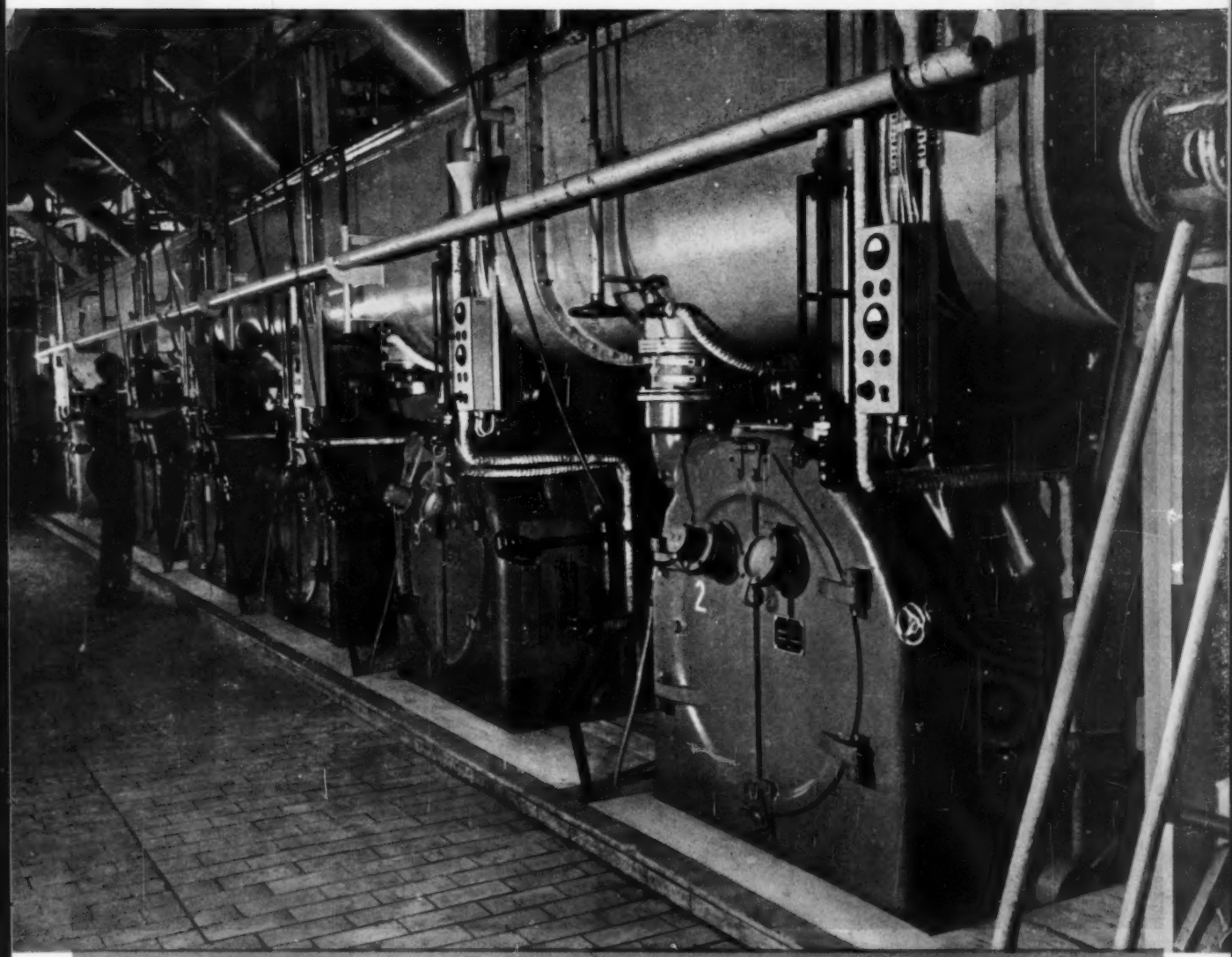
THE ENGLISH ELECTRIC COMPANY LIMITED, ENGLISH ELECTRIC HOUSE, STRAND, LONDON, W.C.2
Electrical Plant Division, Stafford
WORKS: STAFFORD · PRESTON · RUGBY · BRADFORD · LIVERPOOL · ACCRINGTON

5.42

ESCHER WYSS

continuous centrifuges for the sugar industry

A battery of six push-type centrifuges, Model C 4 for medium-product sugar and affinated low-grade sugar, installed at Groningen Sugar Factory / Holland

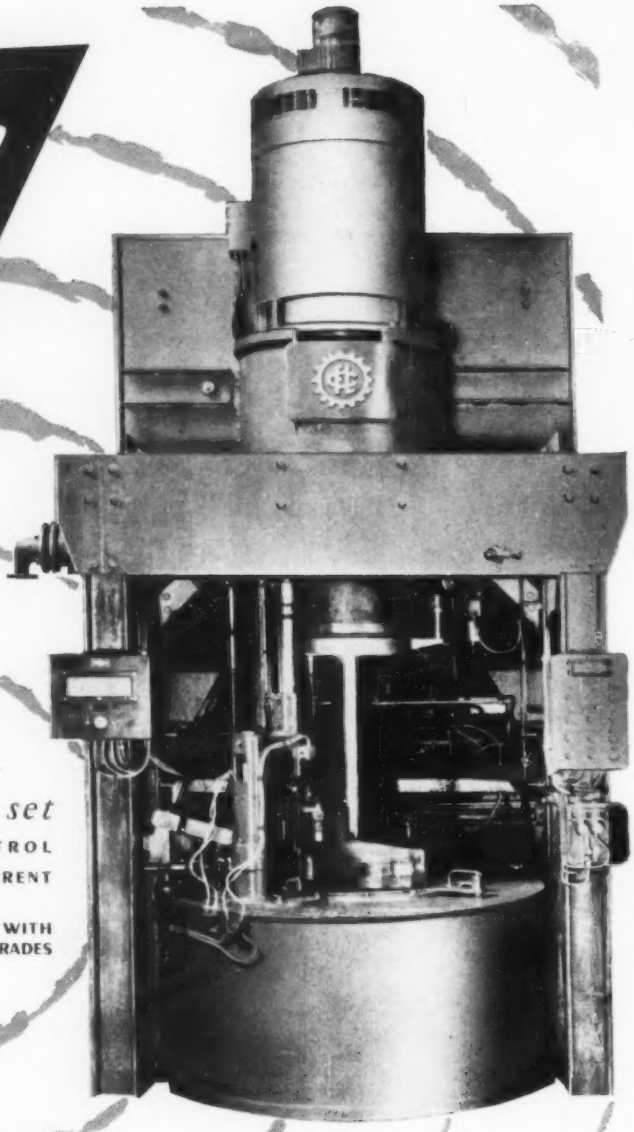


Escher Wyss Ltd., Zurich/Switzerland
London Office: Escher Wyss Ltd.,
Terminal House, Grosvenor Gdns., London, S.W.1, Phone Sloane 8101

Fully automatic!

the new

CENTRIFUGAL



driven by
WARD-LEONARD *set*

- ELECTRONIC CONTROL
- ELIMINATION OF CURRENT PEAKS
- RECORD PRODUCTION WITH MASSECUITES OF ALL GRADES

Battery of 4 centrifugals at the Fontaine-le-Dun Sugar Factory (France)

S.A.G. - PARIS

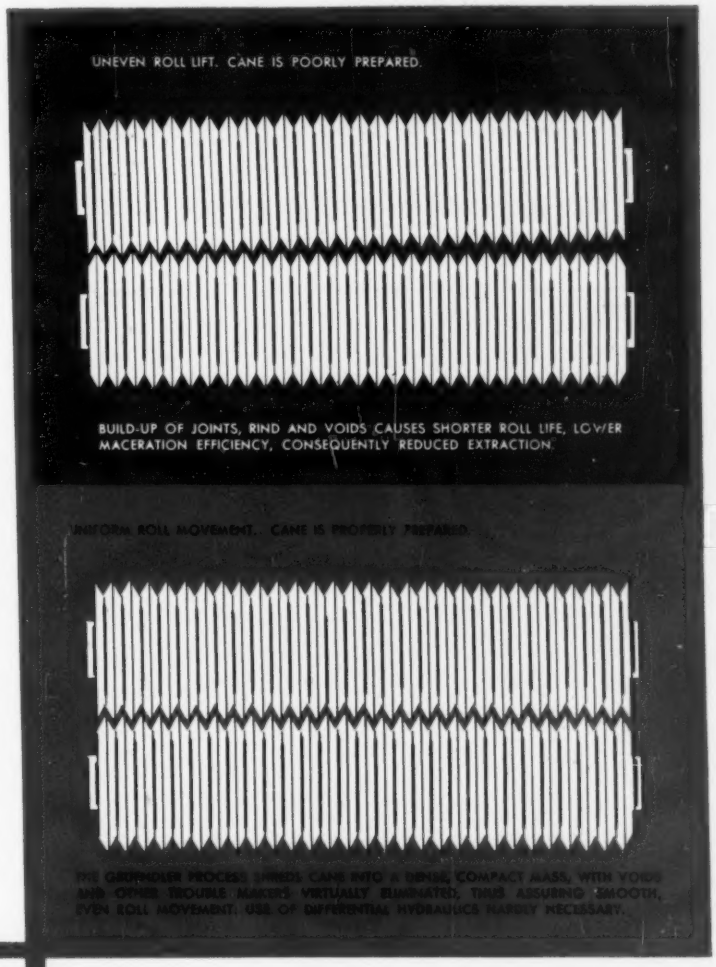
FIVES LILLE - CAIL

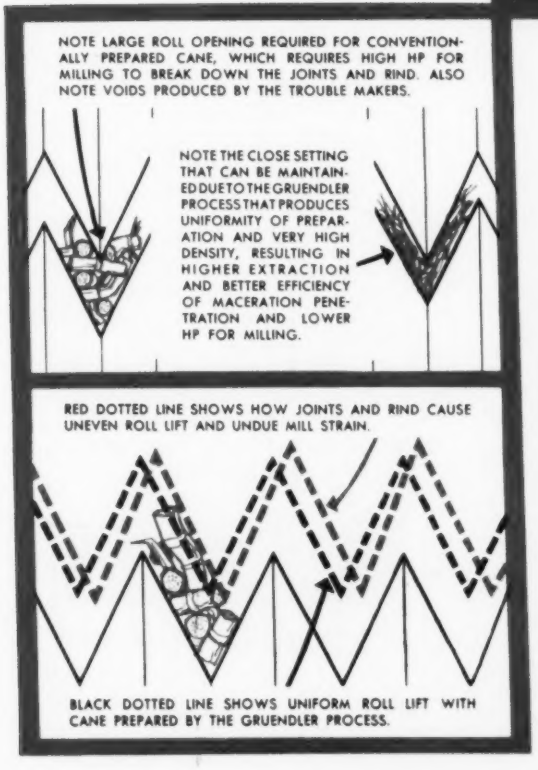
7, rue Montalivet, PARIS (8e) - Tél.: ANJou 22-01 et 32-40

the importance of the Gruendler Cane Shredding Process in obtaining

HIGHEST MACERATION EFFICIENCY

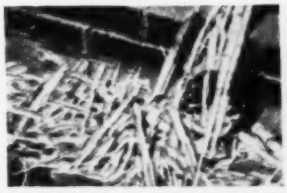
Every experienced sugar man readily understands the importance of cane being shredded into particle size (similar to excelsior) before entering the mill tandem. The Gruendler Cane Shredding Process accomplishes just this, with the result that most trouble makers in cane milling are eliminated once and for all.


UNEVEN ROLL LIFT. CANE IS POORLY PREPARED.
BUILD-UP OF JOINTS, RIND AND VOIDS CAUSES SHORTER ROLL LIFE, LOWER MACERATION EFFICIENCY, CONSEQUENTLY REDUCED EXTRACTION.
UNIFORM ROLL MOVEMENT. CANE IS PROPERLY PREPARED.
THE GRUENDLER PROCESS SHREDS CANE INTO A DENSE, COMPACT MASS, WITH VOIDS AND OTHER TROUBLE MAKERS VIRTUALLY ELIMINATED, THUS ASSURING SMOOTH, EVEN ROLL MOVEMENT. USE OF DIFFERENTIAL HYDRAULICS RARELY NECESSARY.

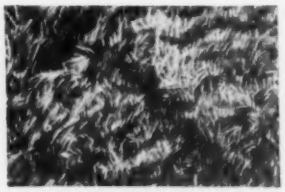

NOTE LARGE ROLL OPENING REQUIRED FOR CONVENTIONALLY PREPARED CANE, WHICH REQUIRES HIGH HP FOR MILLING TO BREAK DOWN THE JOINTS AND RIND. ALSO NOTE VOIDS PRODUCED BY THE TROUBLE MAKERS.
NOTE THE CLOSE SETTING THAT CAN BE MAINTAINED DUE TO THE GRUENDLER PROCESS THAT PRODUCES UNIFORMITY OF PREPARATION AND VERY HIGH DENSITY, RESULTING IN HIGHER EXTRACTION AND BETTER EFFICIENCY OF MACERATION PENETRATION AND LOWER HP FOR MILLING.
RED DOTTED LINE SHOWS HOW JOINTS AND RIND CAUSE UNEVEN ROLL LIFT AND UNDUE MILL STRAIN.
BLACK DOTTED LINE SHOWS UNIFORM ROLL LIFT WITH CANE PREPARED BY THE GRUENDLER PROCESS.

The Gruendler Cane Shredding Process virtually stops all costly trouble makers in cane milling . . . by preparing cane properly.

Advantages: Highest maceration efficiency • Increased sucrose extraction • Increased capacity • Reduced bagasse moisture • Better burning bagasse • Lower power and steam requirements • Less mill strain • Eliminates most tramp iron



BEFORE GRUENDLER PROCESS



AFTER GRUENDLER PROCESS

WRITE! Ask for "Solution to Cane Milling Troubles."

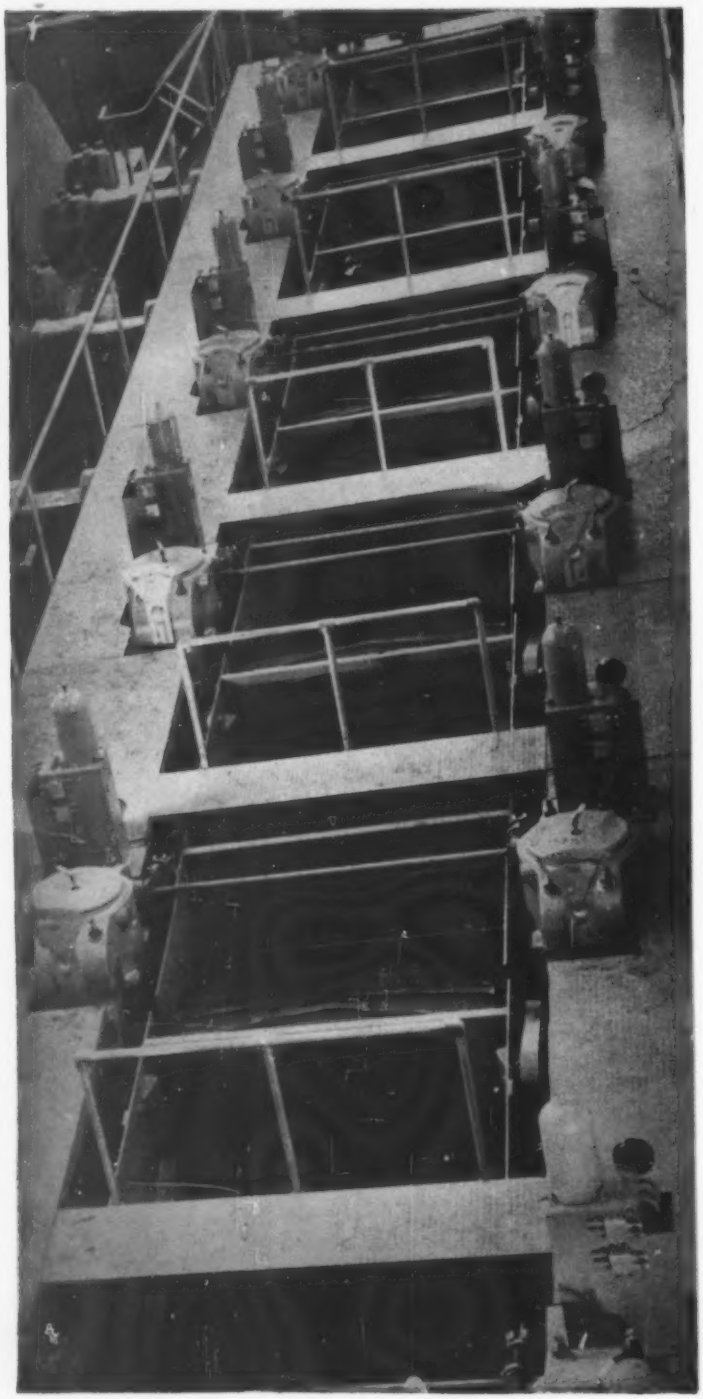
Gruendler

CRUSHER & PULVERIZER CO.

2915 North Market • St. Louis 6, Mo., U.S.A.

Leo Freeman, Mgr. Sugar Mill Div.
2530 Terrace Ave., Baton Rouge, La., U.S.A.

Why the rapidly increasing demand for Farrel sugar mills?



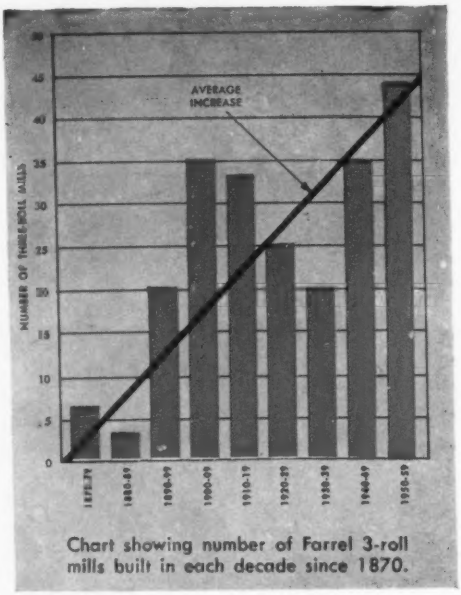


Chart showing number of Farrel 3-roll mills built in each decade since 1870.

Because, in recent years Farrel has pioneered a number of major refinements in sugar-grinding equipment.

For example, improvements in hydraulic ram mechanisms to maintain uniform roll pressure, and the introduction of force-feed rollers have resulted in increased sucrose extraction. Automatic lubrication of roll journals and centralized drive control for individual mills reduce costs for operating personnel.

New designs for side and top caps have been developed to permit fast, vertical removal of all rolls for regrooving and other maintenance. Time required for removal of hydraulic pistons and intermediate carriers has also been reduced.

Stronger housings and safeguards against corrosion add years to the life expectancy of mills. New hardened crownwheels, fabricated gears and rubber-belt carriers are establishing records for durability.

These are only a few of the recent innovations that have led to the increased demand for Farrel mills. For the full story, send for a copy of bulletin 312.

FARREL-BIRMINGHAM COMPANY, INC.
ANSONIA, CONNECTICUT, U.S.A.
Plants: Ansonia and Derby, Conn., Buffalo and Rochester, N.Y.

FARREL®

FB-1201

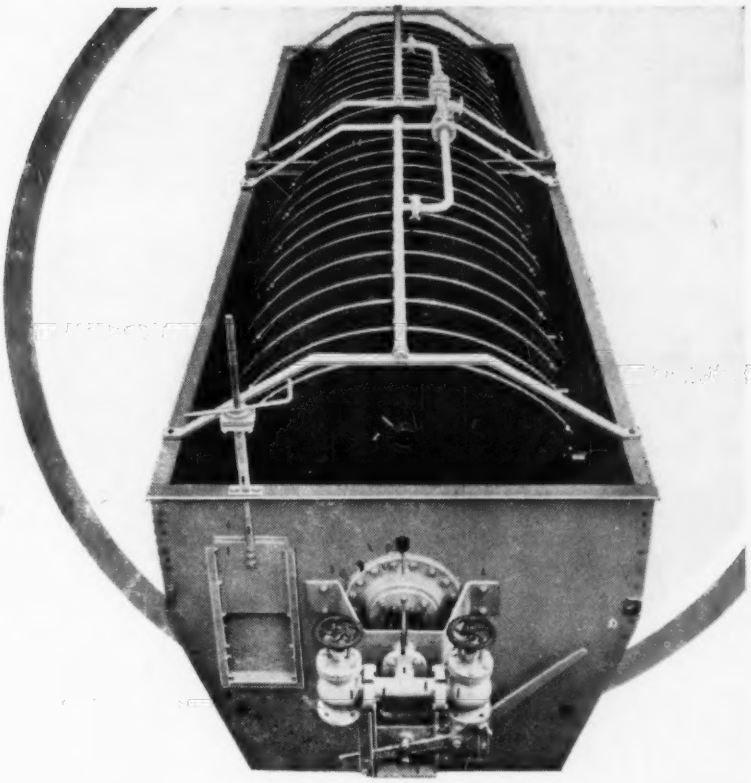
More than 500

WERKSPOOR

Rapid Crystallizers

in use in

sugar factories



Applications for high grade as well as for LOW GRADE masscecuites!

Licensees for the manufacturing of Werkspoor Rapid Crystallizers:

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Genoa - Italy

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Manila - Philippines

Maschinenfabrik Buckau R. Wolf A.G.
Grevenbroich - Germany

Fives Lille - Cail S.A.
Paris - France

Honolulu Iron Works Co. Inc.
Honolulu - Hawaiian Islands

Honolulu Iron Works Co. Inc.
New York - U.S.A.

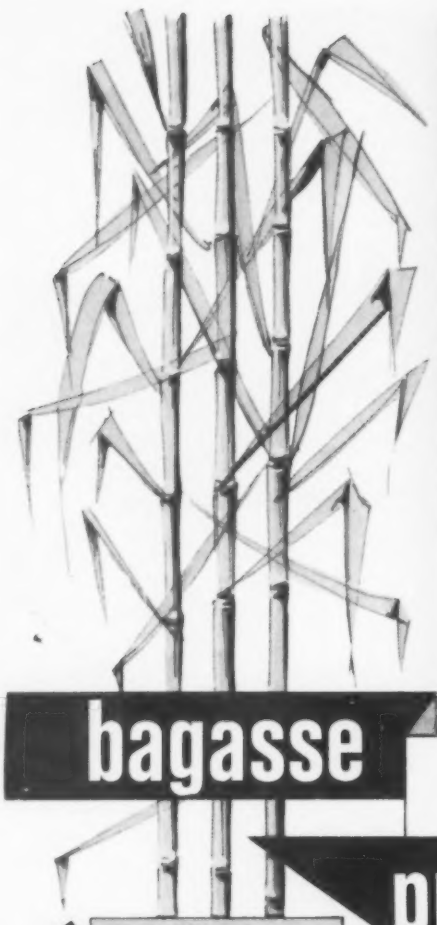
A. & W. Smith & Co. Ltd.
London - Great Britain

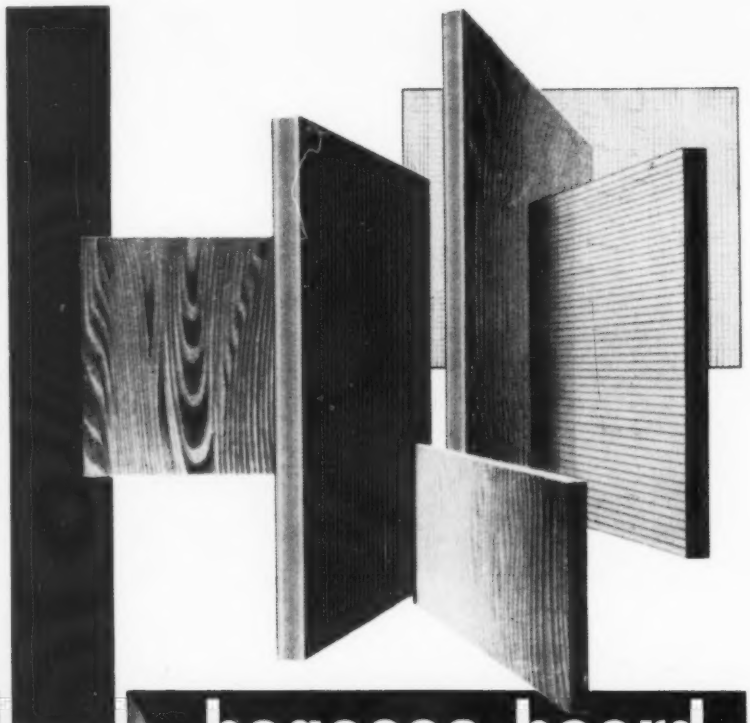
Succesores de Abarca Inc.
San Juan - Puerto Rico

WERKSPOOR

AMSTERDAM WORKS (Holland)

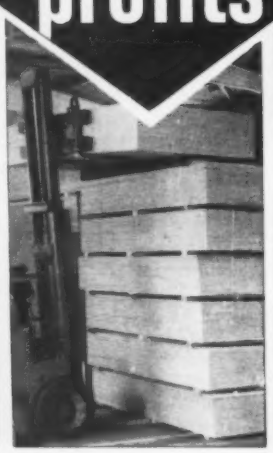
Baudouin





bagasse into bagasse-board

profits



Stop burning your bagasse

Why waste money? Bagasse is an excellent raw material for the production of high quality multi-purpose boards in a wide range of densities, thicknesses and finishes.
Ask for full details. To-day!

interbagasse

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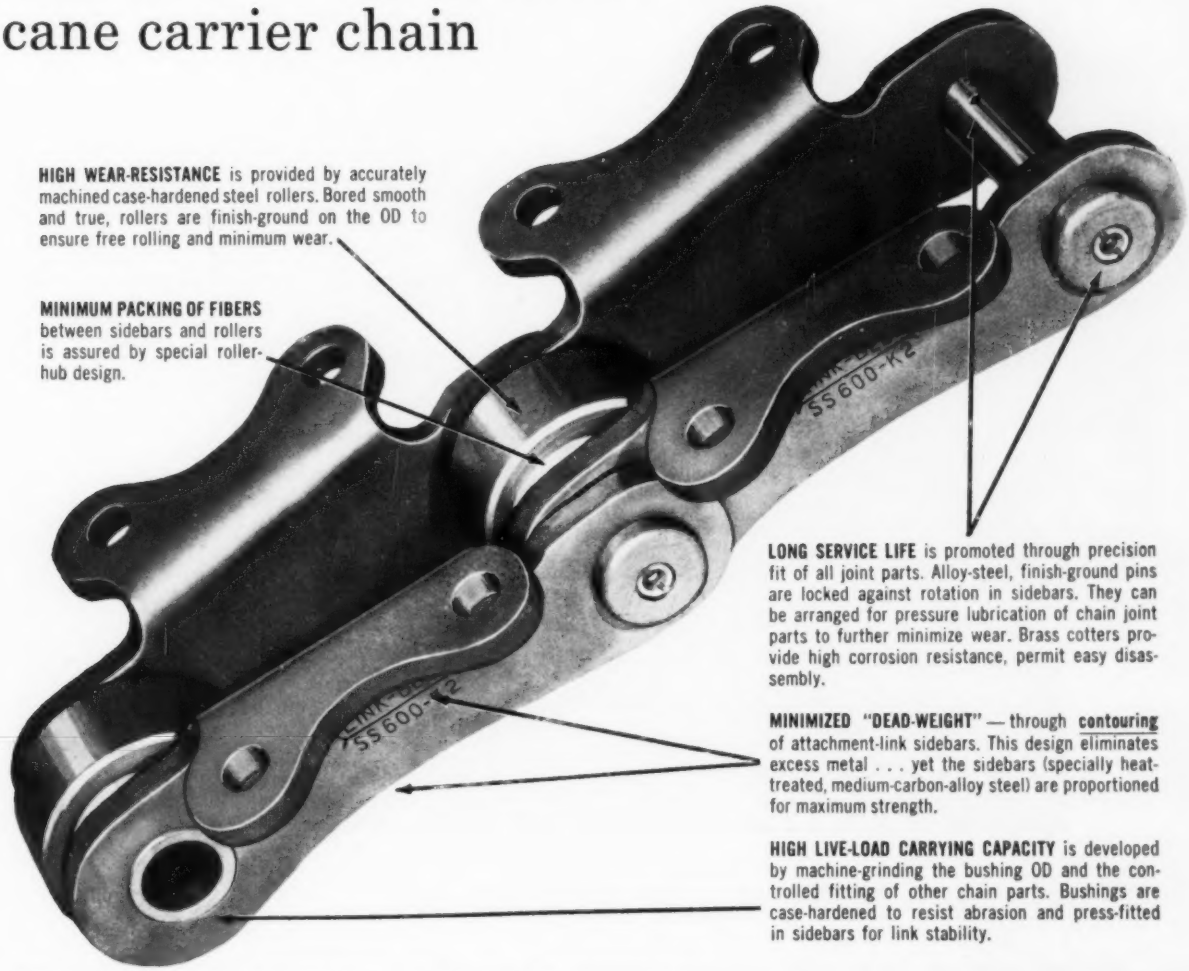
Made to mill operators' specifications!

Link-Belt SS-600

cane carrier chain



HIGH WEAR-RESISTANCE is provided by accurately machined case-hardened steel rollers. Bored smooth and true, rollers are finish-ground on the OD to ensure free rolling and minimum wear.

MINIMUM PACKING OF FIBERS between sidebars and rollers is assured by special roller-hub design.

LONG SERVICE LIFE is promoted through precision fit of all joint parts. Alloy-steel, finish-ground pins are locked against rotation in sidebars. They can be arranged for pressure lubrication of chain joint parts to further minimize wear. Brass cotters provide high corrosion resistance, permit easy disassembly.

MINIMIZED "DEAD-WEIGHT" — through contouring of attachment-link sidebars. This design eliminates excess metal . . . yet the sidebars (specially heat-treated, medium-carbon-alloy steel) are proportioned for maximum strength.

HIGH LIVE-LOAD CARRYING CAPACITY is developed by machine-grinding the bushing OD and the controlled fitting of other chain parts. Bushings are case-hardened to resist abrasion and press-fitted in sidebars for link stability.

Durable, lightweight, easy to service . . . that's what mill operators asked for in cane carrier chain. And Link-Belt meets their demands *exactly* with SS-600. The exceptionally light weight of this 6-inch pitch chain minimizes hp requirements. And this light weight is achieved *without sacrificing strength* . . . average ultimate strength of SS-600 chain checks out at 100,000 lbs!

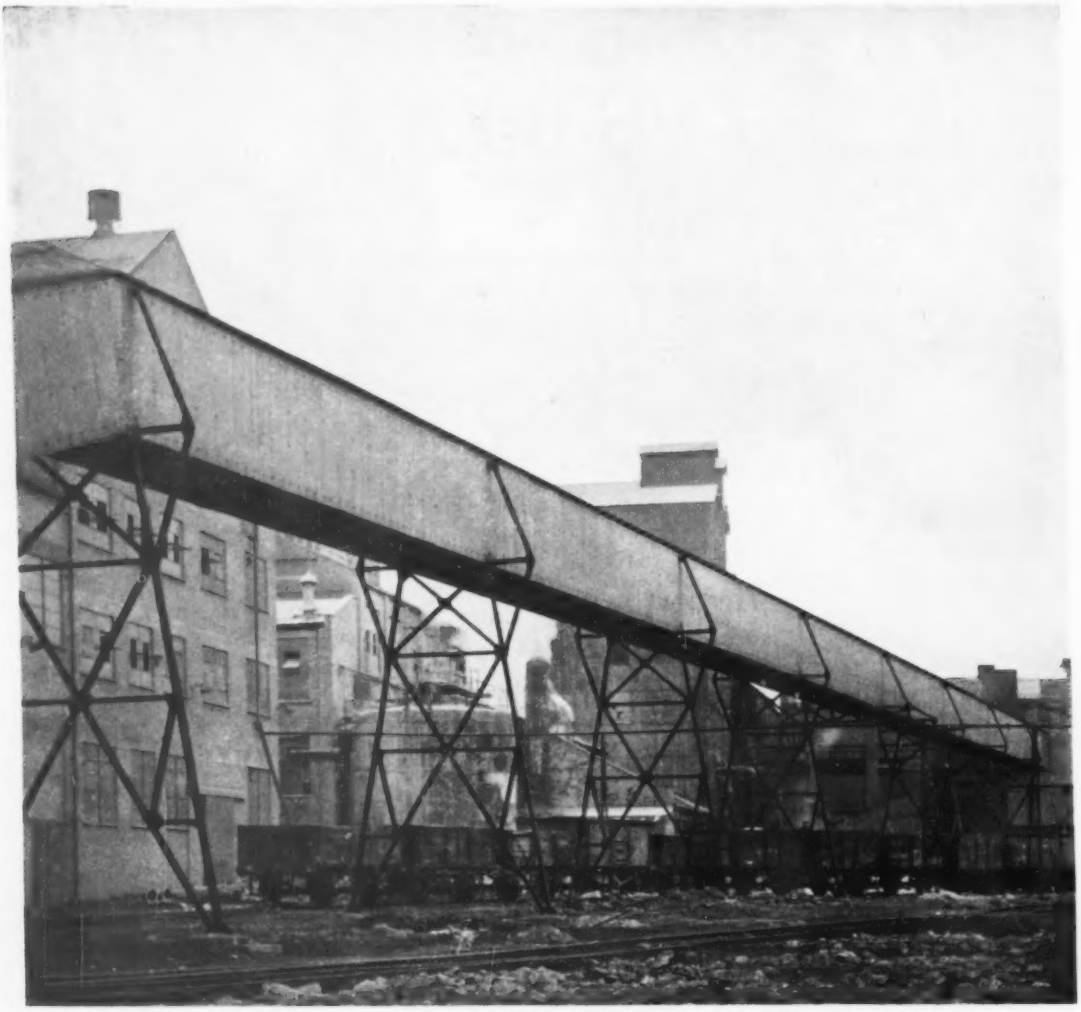
Link-Belt offers other 6-inch as well as 8-inch pitch carrier chains . . . with sprockets to match. Also slats in a wide range of sizes and types. For full details, contact your Link-Belt representative or write direct for Book 2640 covering all Link-Belt sugar-handling equipment.

LINK-BELT

CHAINS AND SPROCKETS

LINK-BELT COMPANY: Engineers . Manufacturers . Exporters of Machinery for Handling Materials and Transmitting Power . Established 1875. Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants and Warehouses in All Major Industrial Areas and District Sales Offices and Stock Carrying Distributors in All Principal Cities. **EXPORT DIVISION**: Dept. 1261-18J, 233 Broadway, New York 7, U.S.A. Cable Address: Linkbelt—New York . Australia, Marrickville (Sydney) . Brazil, Sao Paulo . Canada, Scarboro (Toronto) . South Africa, Springs . Switzerland, Geneva . Representatives Throughout the World.

EASY SERVICING! Offset sidebar design of Link-Belt SS-600 chain permits removal of *single* links. This simplifies chain adjustment.



SUGAR HANDLING PLANT by

NEWCON

Manufacturers of all types of
RAW, WHITE and BEET PLANTS·
EQUIPMENT INSTALLED
IN ANY PART OF THE WORLD

NEW CONVEYOR COMPANY LIMITED

A COMPANY

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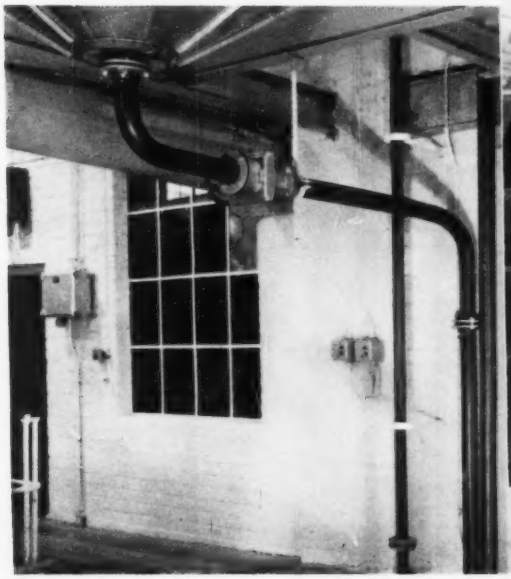
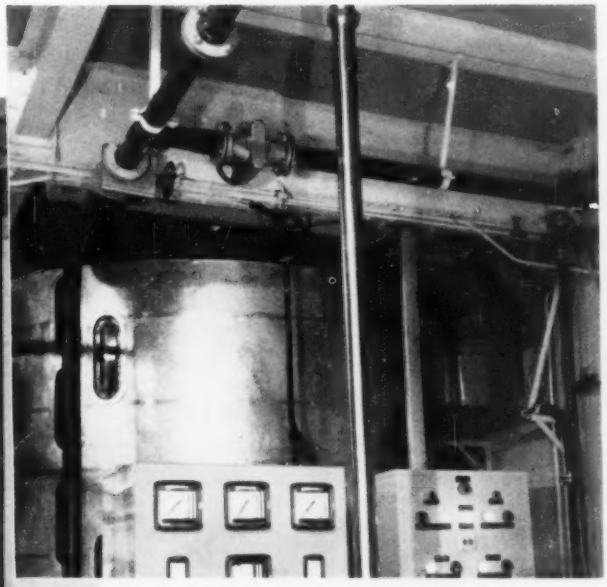
'POLYORC BH' HIGH IMPACT P.V.C. PIPELINE IN A SUGAR FACTORY





Photographs by courtesy of
BRITISH SUGAR CORPORATION LTD.

These photographs show part of the pipelines conveying Liquid Sugar at the Bardney factory of British Sugar Corporation Ltd. using—

YORKSHIRE IMPERIAL

'POLYORC BH'

HIGH IMPACT P.V.C. TUBES and
MOULDED SOCKET STUB FLANGES

'POLYORC BH' is suitable for all types of industrial and chemical pipelines. It is tough, light in weight, resistant to most corrosive agents and quickly and economically installed. Ranges of standard fittings are available.

Write for your copy of the 'Polyorc BH' Catalogue

YORKSHIRE IMPERIAL METALS LIMITED

HEAD OFFICE—P.O. BOX 166, LEEDS. TELEPHONE: LEEDS 7-2222.

The Crystalloscope is an instrument designed for controlling and improving the process of sugar boiling. It also finds application in some fields of the pharmaceutical and chemical industries.

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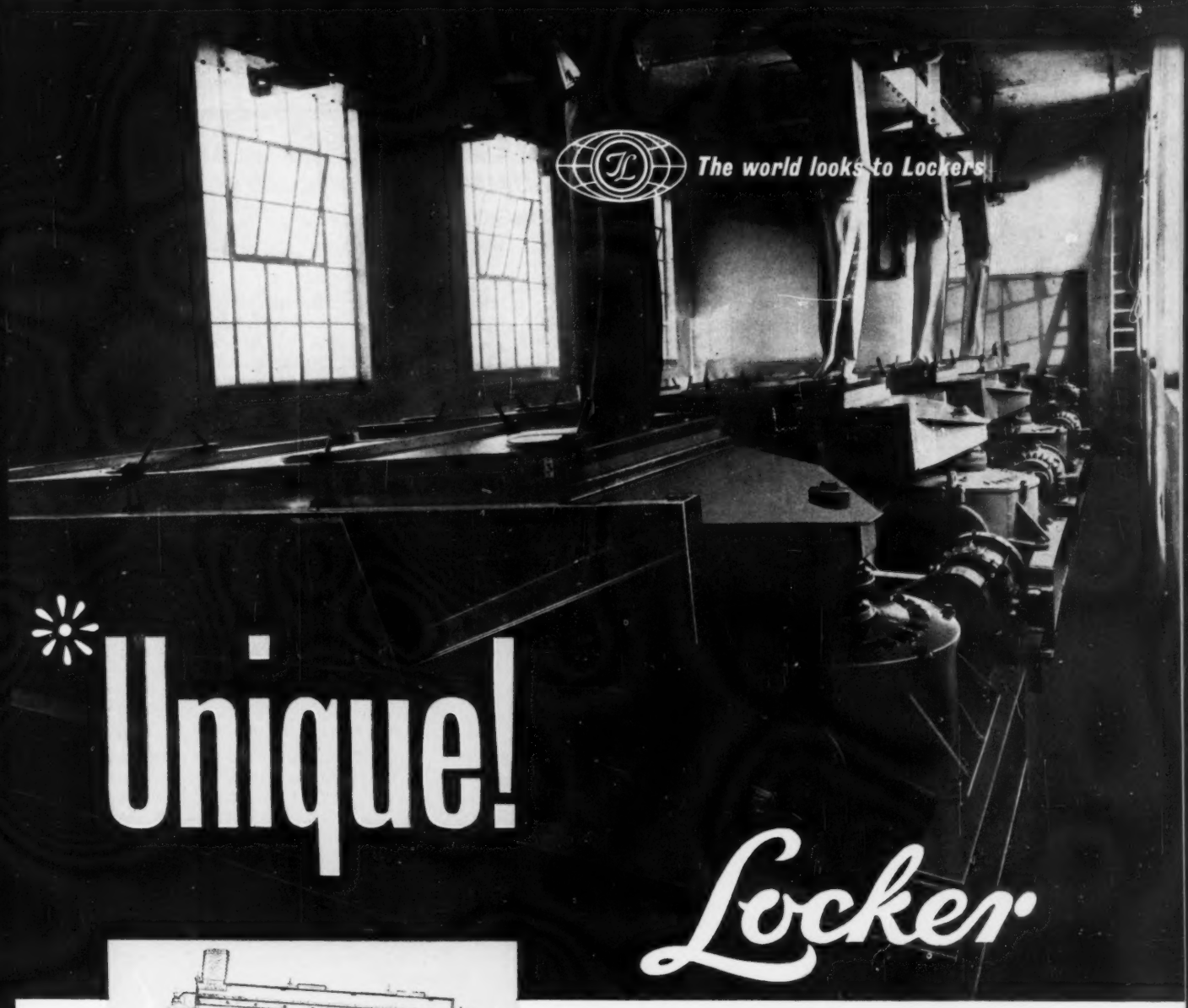

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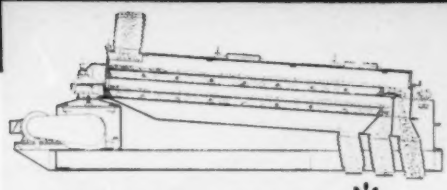

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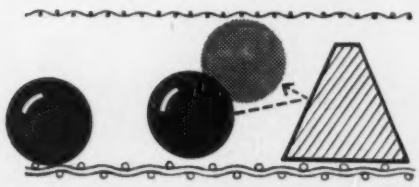

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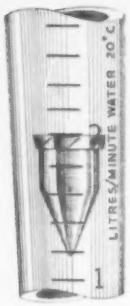

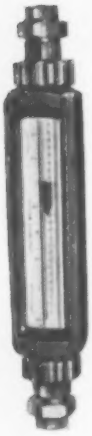

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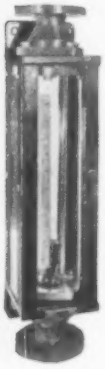

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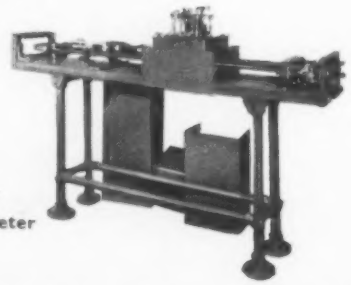

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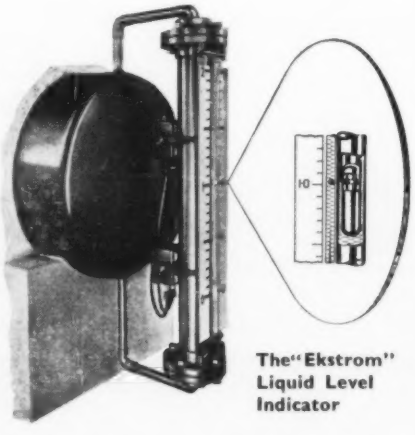

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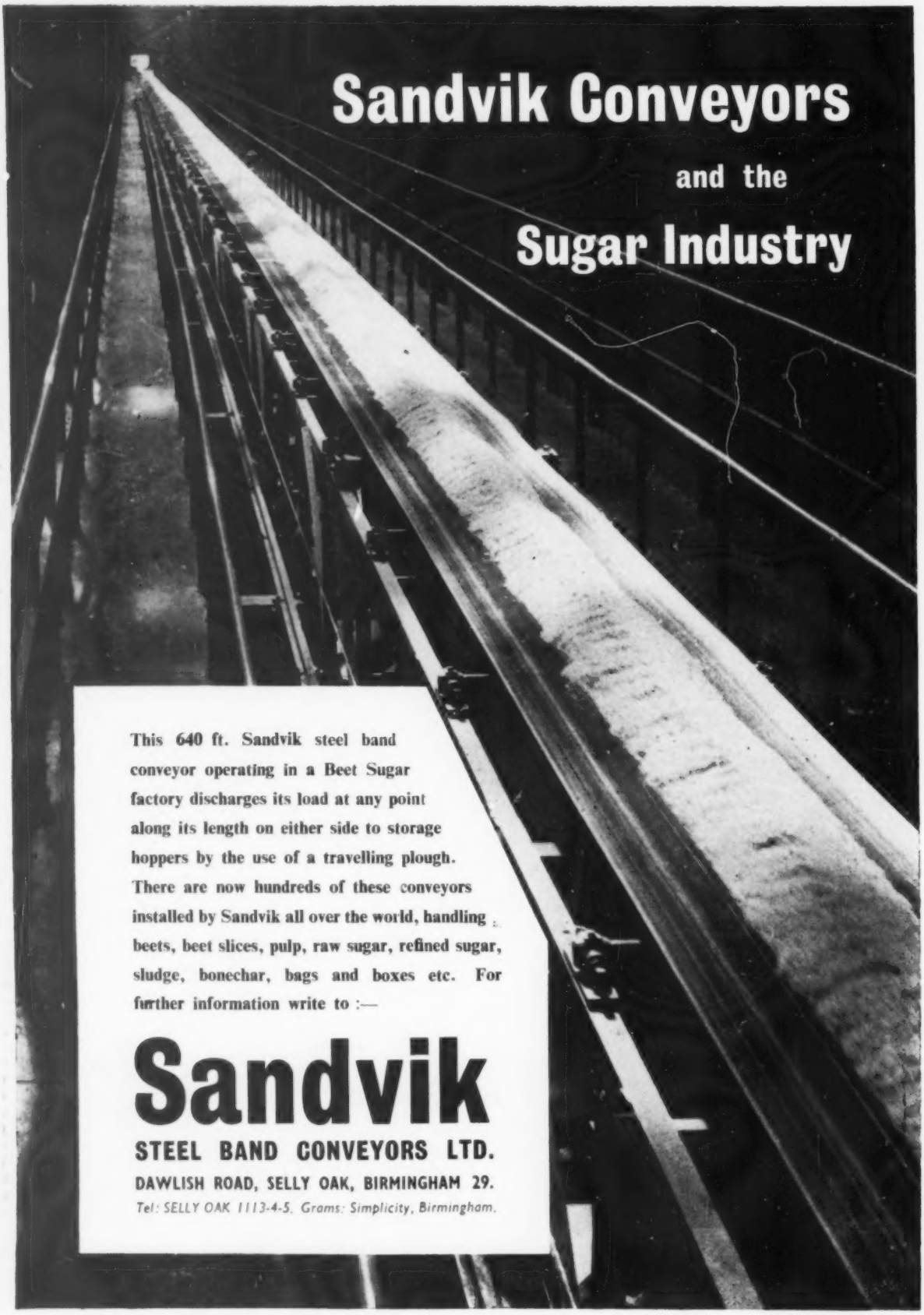

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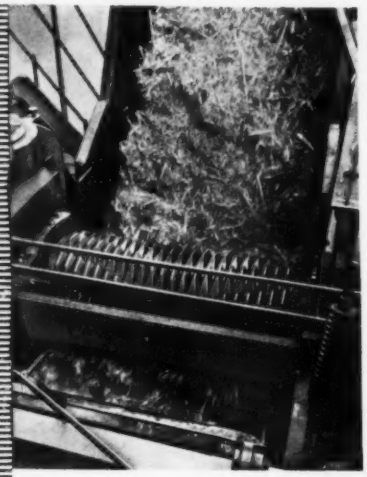

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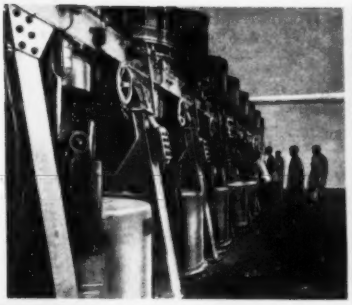

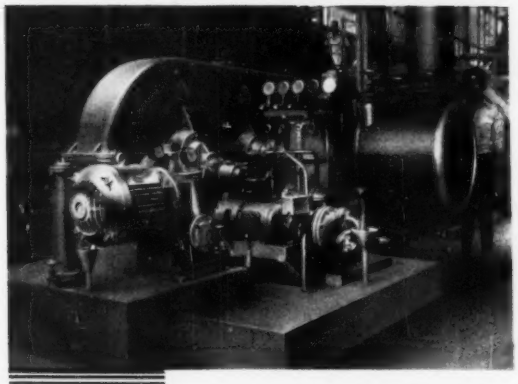

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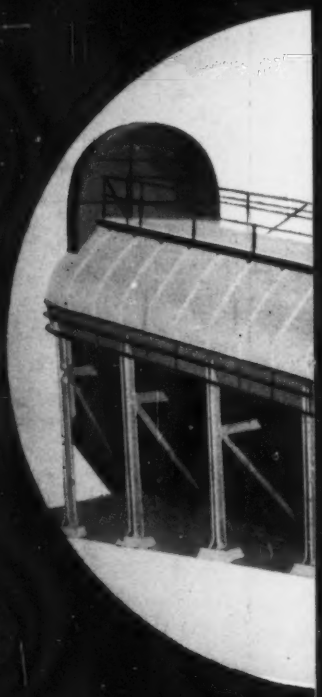
Average	2 994	15.01	14.44	0.39	17.0	0.11	114



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PAGE

Notes and Comments .. 357
International Sugar Conference. South African sugar sales to the United Kingdom. International Sugar Council. U.S. sugar quota shortfalls. Sugar retail sales promotion. New York Terminal Market No. 9 Contract.

* * *

Agricultural Articles:

The Overhead Irrigation of Sugar Cane in Natal 359
(Part II)
By T. G. Cleasby, Ph.D.

Cane Agriculture in Cuba .. 362

Soil Rejuvenation with Crushed Basalt in Mauritius 363
Part I.—Consistent results of world-wide interest.
By O. D'Hotman de Villiers.

Agricultural Abstracts .. 362, 364, 365

* * *

General Articles:

The Calculation of Mill Delivery Settings .. 366
By C. R. Murry and J. E. Holt.

Adsorption by Bone Char using a Continuous Adsorption Process (CAP) (Part II) .. 368
By Willard Marcy, Ph.D.

Thick Juice Storage .. 371
By V. I. Morris.

* * *

Sugar-House Practice .. 374
Throughput and purging efficiency of a continuous centrifugal. The production of kieselguhr filter aid in the Ukraine. Rationalization of production of pressed refined sugar at Khutor-Mikhailovsk factory. Expansion of Wanli sugar mill *etc.*

Beet Factory Notes .. 377
The Kollár predefecation unit. Pectins and their role in sugar manufacture. Some problems of instrumentation and automation in sugar production *etc.*

New Books and Bulletins .. 379
Zuckerwirtschaftliches Taschenbuch 1960. Azúcar Mexicano. Blyth, Greene, Jourdain & Company Limited 1810–1960. Sugar Year Book 1960.

Laboratory Methods and Chemical Reports .. 380
Polarographic determination of α-amino acids. Sucrose solubility. III. Limitations of solubility tables. pH determination of beet raw sugar *etc.*

By-Products .. 383
Filter-press muds from Kirgiz sugar factories. The effect of ammonium sulphate and superphosphate on sugar destruction. Protein from sugar on Taiwan *etc.*

Patents .. 384
Storage of sugar beet roots. Beet diffuser. Dehydrating flowable matter (molasses). Beet harvester (finger wheel assembly). Citric acid fermentation.

Trade Notices .. 385
The Clarkson valve type "J". "Adcora Pervon". The "Dalamatic" automatic dust collector. Automatic bunker clearance installations. The Forplex Mill *etc.*

Per Caput Consumption of Centrifugal Sugar .. 387

Stock Exchange Quotations .. 388

Brevities .. 388

Index to Advertisers .. liv

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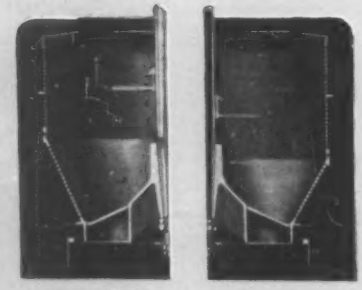

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THE
INTERNATIONAL SUGAR JOURNAL

VOL. LXIII DECEMBER, 1961 No. 756

NOTES AND COMMENTS

International Sugar Conference.

The United Nations Sugar Conference, which had been reviewing since the 12th September the working of the 1958 Agreement, interrupted its work on the 23rd October without reaching a positive result. The Executive Committee has adjourned and it was intended to meet again towards the end of November to continue and conclude the work of the Conference. Commentators have said that delegates considered that there was no reason for pessimism and that a compromise may be reached when the Conference re-convenes, but it is disappointing that new quotas have not been fixed in view of the unsettled nature of the free market following the U.S.-Cuban break.

A principal obstacle to the success of the negotiations in Geneva has been the Cuban insistence on an increased export quota of 7,285,000 metric tons. This was based on her reported commitment to sell a minimum of 4,860,000 tons to the Communist countries which were backing Cuba in her claim. This quantity is divided as follows:

U.S.S.R.	3,000,000
Mainland China	1,200,000
North Korea	100,000
Poland	150,000
Czechoslovakia	150,000
East Germany	120,000
Bulgaria	60,000
Roumania	50,000
Hungary	30,000

As F. O. Licht comments[1], "While the Soviet Union declared her intention to retain her share of the purchase, there is no doubt that most of the other sugars sold to East Europe will be resold. The argument that Cuba created a new market for the full quantity of her East Block sales was therefore disputed at the Geneva conference."

Cuba has been reported willing to reduce her demands to 6,800,000 tons, while other members were willing to agree to 5,800,000 tons. The Cubans have been adamant, however, that they would not accept this and their representatives are quoted as saying that the adjournment will not influence their attitude. Indeed, according to *Lamborn*[2], Dr. CEPILLO BONILLA, the chief delegate, has said "the way things are going, there doesn't seem much point in our coming" to the November meeting.

It is understood by C. Czarnikow Ltd.[3] to be the view of certain delegations that, failing any further decisions which may be made before the end of the year, the Agreement will continue in its present form until it expires at the end of 1963. "Whether all would agree with this statement, however, seems very doubtful to say the least.

"Although it is possible, and it is certainly to be hoped, that agreement will be reached when the Conference reconvenes, the market must take stock of the 1962 position on the basis of there being no Agreement in existence. Without the controlling influence of a quota system, values will reflect the true result of the opposing forces of supply and demand, but it does not necessarily follow that without an Agreement prices are bound to fall. It may well be that producers and consumers, either working unilaterally or in conjunction with other members of the same geographical, political or trading groups, will decide to take steps designed to raise values. Indeed, in the past, action by the Cuban Institute in restricting the tonnage available for free sale to the world market was often instrumental in stemming the erosion of values and on occasions led to improved values irrespective of what the statistical indications showed."

* * *

South African sugar sales to the United Kingdom.

Discussions held between the U.K. Food Ministry and the South African Sugar Association have led to agreement in principle on the following arrangements for the trade in sugar between South Africa and the United Kingdom after the end of 1961, when the South African Sugar Association's rights and obligations under the Commonwealth Sugar Agreement come to an end.

The Ministry of Agriculture will purchase 150,000 long tons a year of raw sugar from the South African Sugar Association at a price of £35. 15s. 0d. a ton, basis of 96° f.a.s. Durban. (This is the same quantity as the basic amount purchased from South Africa

[1] *International Sugar Rpt.*, 1961, **93**, (Supp. 19), 249.
[2] 1961, **39**, 197.
[3] *Sugar Review*, 1961, (531), 185.

under the Commonwealth Sugar Agreement.) Exports of sugar to the United Kingdom from South Africa in excess of this quantity will be made only in agreement with the Ministry of Agriculture, and will be sold to buyers in the United Kingdom at the ordinary market price.

These arrangements will last for the five years 1962–1966 inclusive. The provisions for the years 1964–1966 will be subject to review, and to such modifications as may be necessary in the event of any changes in the international obligations affecting the trade in sugar of either the Government of the United Kingdom or the Government of the Republic of South Africa.

Discussions on the details of this Agreement will continue. But in view of the shortness of time for making arrangements for shipments in 1962, plans are being made immediately for the purchase of sugar by the Ministry for 1962.

The opportunity has also been taken to review with the Government of South Africa and the South African Sugar Association the arrangements for the marketing in South Africa of sugar produced in Swaziland. The South African Government and the Association have confirmed that the existing marketing arrangements will continue unchanged. It has also been agreed that in the 1964/5 production season and subsequent years the present figure for Swaziland sugar production of 80,000 short tons should be replaced by a limit of 8½% of the total sales of South African and Swaziland sugar, thus giving the Swaziland sugar industry an opportunity of sharing in any increase in the South African markets for sugar.

* * *

International Sugar Council.

During its 11th Session in Geneva, the International Sugar Council, taking account of disastrous floods which have recently befallen the State of Bihar in India, and the particular hardship which followed, established on the 23rd October a reserve of 40,000 tons under Article 18(6) of the International Sugar Agreement and allocated 20,000 tons from that reserve to India.

* * *

U.S. sugar quota shortfalls.

On the 13th October the U.S. Dept. of Agriculture announced a shortfall of 30,000 short tons in respect of the non-quota allocation to Peru, reducing her overall U.S. entitlement to 636,377 short tons.[1] The shortfall was not re-allocated to other countries and the Department stated that it did not plan to re-allocate further expected shortfalls in the allocations to other foreign countries. On the 23rd October reductions totalling 100,000 tons were also announced[2], without reallocation. India's allocation was cut by 50,000 tons to 175,000 tons, Brazil's by 30,000 tons to 306,474 tons and Taiwan's by 20,000 tons to 170,028 tons. The announcement stated that these countries had relatively large quantities remaining in their allocations which they could not deliver until late November or December when the deliveries would be large in relation to refiners' needs at fair prices, so that the quantities which could be supplied were cut. Except for the cancellation of the Cuban quota in 1960 this is the first time since the inception of the quota law that a quota involving sugar already purchased, and in some cases shipped, has been cut back. The Peruvian shortfall was reported to be voluntary but no mention has been made of consultation with the other three Governments and from Brazil it is reported that some confusion has arisen as the Brazilian Institute had sold all its full entitlement and had entered into financial commitments in consequence. It is understood that all the Indian allotment had also been sold.

* * *

Sugar retail sales promotion.

The inclusion of coupons with cigarettes, plastic cars in the cornflakes packet and similar "gimmicks" are a feature of modern life which has spread rapidly since the war, in North American and West European countries at least. Whether this type of salesmanship is desirable, however, is a matter of argument, particularly to the housewife who has to stock a wide range of cereals to satisfy the collecting manias of her children rather than their appetites.

Now it seems that the technique has spread to sugar[3]. It is announced that new packages of "Jack Frost" sugar from National Sugar Refining Co. of the U.S.A. will carry an offer whereby for one box top or bag emblem plus 35 cents, the housewife will receive a sugar spoon—part of a "Family Treasure" dinner set which will be listed on the back of the sugar packet and illustrated in a leaflet sent with the spoon. It remains to be seen whether other U.S. refiners will follow suit with their own "valuable offers."

* * *

New York Terminal Market No. 9 Contract.

The membership of the New York Coffee & Sugar Exchange approved trading on the new No. 9 Contract by a vote held on November 2nd. The new contract is basically the same as the No. 8 Contract but, in addition to the cane raws deliverable, includes European raw beet sugars from Austria, Belgium, Denmark, France, Holland, Italy, Poland, Spain, Sweden, Turkey, the United Kingdon and West Germany, under the same terms and conditions as the cane raws but deliverable at a discount of 10 points under the cane price. The spot price will continue to be quoted on a basis of cane raws. Cuban cane sugar may be added as a deliverable sugar by a two-thirds vote of the Board of Managers. The contract calls for delivery of beet raws f.o.b. and stowed at Dunkirk, Antwerp or Hamburg.

[1] *Lamborn*, 1961, **39**, 191.
[2] *ibid.*, 196.
[3] *Willett & Gray*, 1961, **85**, 441.

THE OVERHEAD IRRIGATION OF SUGAR CANE IN NATAL

By T. G. CLEASBY, Ph.D.
(Research Officer, Tongaat Sugar Company, Maidstone, Natal, South Africa.)

Paper presented to the "Africa and Irrigation" Symposium, Salisbury, Southern Rhodesia, August 1961.

PART II

The way this system operates at Illovo has been very well described by THOMPSON[1]. The 1463 acres under irrigation are made up of two schemes, one on alluvium flats and another on the hills. They differ from the schemes described above in that no dams are used. The flats scheme pumps water directly from the river and rainer change-overs are done by synchronized watches. Because of the flat land 2 in of effective water is applied per application. Similar reticulation equipment is used to that already described.

On the hillside schemes water is pumped from contour furrow canals by portable pumping units which are moved from station to station. Only 1 in effective irrigation is applied per application. The duty of water employed in the Illovo scheme is 1 cusec to irrigate approximately 200 acres.

When to irrigate and when to stop irrigating, are the two essential factors in irrigation control. After examining the possibilities of tensiometers, gypsum blocks, direct sampling and other methods, it has been agreed that an evapotranspiration approach offers the most convenient from of control in Natal. That is to say, the evaporation from an open surface of water (Standard British Evaporation Tank) is related to the evapo-transpiration from a field of closed-in cane by Penman's factor of 0·85[2]. A day-to-day estimate of the soil moisture deficiency is recorded for each field by taking this as a negative factor and the rainfall as a positive factor, from the time when the soil was at last at field capacity. Under conditions where irrigation is supplementary, errors which come into this calculation are wiped out from time to time by heavy rainfall which restores the soil to field capacity.

At Tongaat, a simplified modification of THOMPSON's method is in use. Laboratory and field tests have indicated that the moisture holding capacity of the dolerite, middle and lower ecca shales which form the bulk of the soils irrigated, is of the order of 2·5 inches per acre foot. Only the top foot is considered in practice, as these soils are generally shallow and the major part of the cane root system is concentrated in this region. Furthermore, 1 inch is taken as the effective application of water per irrigation and as THOMPSON recommends, isolated rains of less than 0·3 inches are ignored in the day-to-day soil moisture calculation. The control system then demands that irrigation begins when the estimate of the soil moisture is 1·0 in below field capacity and that the rainer completes its round before the moisture deficiency has reached 2·5 in below field capacity which is the theoretical permanent wilting point. In other words, the function of irrigation is regarded as being to prevent the wilting point being reached, as this is when the growth of the plant begins to suffer seriously from a lack of available water. The system is not designed to maintain the soil moisture at a specific level, and should the rainfall completely fail, then wilting point would be reached. However, some rain can be expected in every month of the year and, at Tongaat, it has been considered uneconomical to cater for the very severe droughts which happen from time to time. The cane survives them even without irrigation, so it must fare better with some supplementary water.

On this basis, Table V summarizes the irrigation requirement and duty of water for the different months of the year. It appears from this that a scheme which is capable of applying 1 inch of effective irrigation in 12 to 15 days, will give adequate protection against drought in the winter and sufficient scope for promoting growth in the summer. It will not, however, give complete protection against a three week drought in January or February but, as has already been mentioned, it is doubtful if this happens frequently enough to warrant the increased capital expenditure on the scheme to provide protection. The duty of water for a scheme which can apply 1 inch in 12 to 15 days is of the order of 250–300 acres.

Mr. C. H. O. PEARSON is presenting a paper to this conference dealing with work done in Natal to establish a true relationship between open tank evaporation and the evapo-transpiration of cane when the soil is maintained as field capacity. Work in the West Indies, Puerto Rico and Hawaii has produced factors ranging from 0·58 to 1·30, so it has been very necessary to undertake such a study in Natal. It must be admitted that experiments, crop-logging techniques and observations under local conditions suggest that Penman's factor applied to the evaporation from a standard tank gives a reasonable picture of the soil moisture deficiencies, if 2·5 inches is taken as the available moisture in the soil. If the actual factor is in excess of 0·85, as the work to be reported by PEARSON suggests, then it is possible that the 1 foot of soil assumption has been too conservative and in actual fact it should be increased to 18 inches. This has been done at Illovo.

[1] *Proc. 34th Congr. S. African Sugar Tech.*, 1960, 161–167.
[2] PENMAN: *Proc. Royal Soc.* 1948, **A193**, 120–145.

Table V

Evaporation and the Duty of Water in Natal

Month	Average monthly evaporation (inches)	Average monthly evapotranspiration (inches) Evapn. × 0·85	Days to reach wilting point with available moisture 2·5 in per acre/ft (days)	Irrigation required to prevent wilting point from being reached	Duty of water corresponding to rate of application in previous column 100% efficiency	75% efficiency	Protection against wilting point being reached if 1 ft in 15 days is applied %
January	5·6	4·8	15	1″ in 9 days	216 acres	162 acres	60
February	4·8	4·0	18	1″ in 11 ,,	264 ,,	198 ,,	75
March	4·4	3·8	20	1″ in 12 ,,	288 ,,	216 ,,	80
April	3·4	2·8	28	1″ in 17 ,,	408 ,,	306 ,,	100
May	2·8	2·4	30	1″ in 18 ,,	432 ,,	324 ,,	100
June	2·4	2·0	38	1″ in 23 ,,	552 ,,	384 ,,	100
July	2·6	2·2	35	1″ in 21 ,,	504 ,,	378 ,,	100
August	2·9	2·5	30	1″ in 18 ,,	432 ,,	324 ,,	100
September	3·6	3·1	25	1″ in 15 ,,	360 ,,	270 ,,	100
October	4·1	3·5	23	1″ in 14 ,,	336 ,,	252 ,,	100
November	4·8	4·0	20	1″ in 12 ,,	288 ,,	216 ,,	80
December	5·4	4·6	18	1″ in 11 ,,	264 ,,	198 ,,	75

NOTE.—(i) Number of days to reach wilting point is calculated from the previous column.

(ii) The irrigation required to prevent the theoretical wilting point from being reached is calculated from the monthly evapo-transpiration figure, assuming that irrigation begins when the soil is 1 in below field capacity and 1 in effective irrigation is applied.

The next question is, what order of response has been obtained from irrigation in Natal? Replicated experiments have been carried out at Tongaat and Illovo and two such experiments will be mentioned here. All experiments have shown a spectacular response to water and have been carried out on soils typical of those under field irrigation.

In the Tongaat experiment water has been applied from a perforated boom which spans the plot. The boom is carried on a steel cable supported by corner poles and is moved from end to end of the plots by hand. The water delivered from the boom is metered so that the amount applied can be controlled accurately. Although the system is not quite comparable to field sprays, it has been considered an acceptable substitute. The method has the advantage of not being affected by wind.

The experiment has been designed to observe the response to applications of water which restore the soil moisture to field capacity at intervals of 7, 14 and 21 days, the soil moisture deficiency being calculated from evaporation data and rainfall. Three levels of nitrogen have been used and the results for the plant cane crop and two ratoons are summarized in Table VI.

Table VI.

Results of Tongaat experiment—Variety N:Co 310

PLANT CANE—21 MONTHS

Treatment	Rain in	Yield t.c.a.	Sucrose %
No irrigation	76	34·9	15·5
26 in on 7 day cycle	76	57·1	16·2
21·0 in on 14 day cycle	76	49·4	15·9
20·0 in on 21 day cycle	76	48·6	15·9
300 lb/acre Ammonium Nitrate		46·3	16·2
600 ,, ,,		46·0	15·8
900 ,, ,,		50·2	15·7
Fertilizer:			
Superphosphate		100 lb/acre	
Muriate of potash		300 lb/acre	

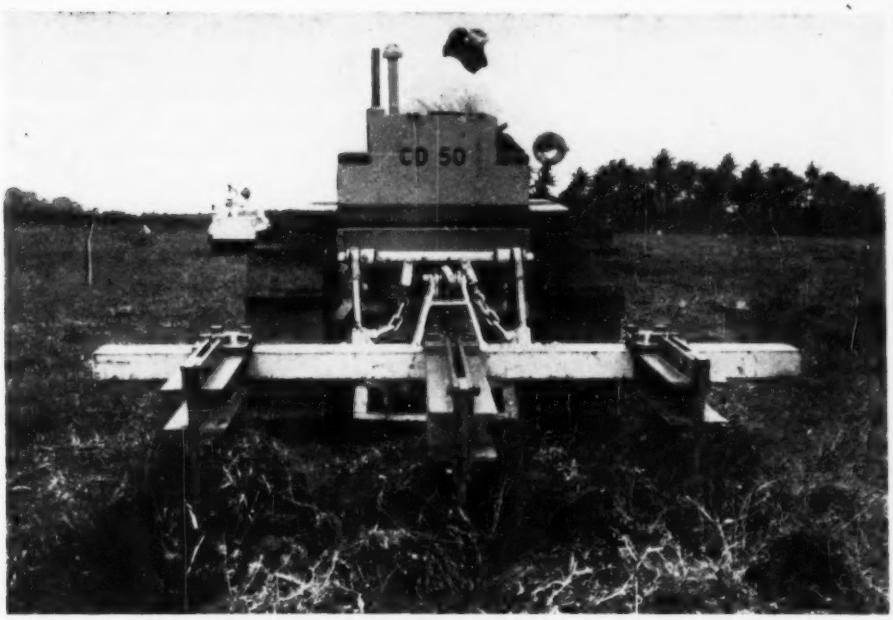
FIRST RATOON—13 MONTHS

Treatment	Rain in	Yield t.c.a.	Sucrose %
No irrigation	48·5	27·8	14·42
18·0 in on 7 day cycle	48·5	43·5	15·31
14·0 in on 14 day cycle	48·5	41·1	15·62
14·0 in on 21 day cycle	48·5	42·7	15·84
300 lb/acre ammonium nitrate		35·4	15·29
600 ,, ,,		40·0	15·36
900 ,, ,,		41·0	15·25
Fertilizer:			
Superphosphate[1]		500 lb/acre	
Muriate of potash		450 lb/acre	

SECOND RATOON—18 MONTHS

Treatment	Rain in	Yield t.c.a.	Sucrose %
No irrigation	40	21·2	14·2
33 in on 7 day cycle	40	56·8	14·3
30 in on 14 day cycle	40	50·7	14·4
29 in on 21 day cycle	40	47·5	14·6
300 lb/acre ammonium nitrate	40	39·7	14·4
600 ,, ,,	40	45·3	14·4
900 ,, ,,	40	47·1	14·4
Fertilizer:			
Superphosphate		500 lb/acre	
Muriate of potash		300 lb/acre	

At Illovo, THOMPSON[2] has developed another technique using small quarter circle rainers which irrigate the plots by throwing water in from the four corners. The quantity of water delivered to the plots is metered and only applied under wind-free conditions which has entailed work at night. Two levels of irrigation have been used and compared with an unirrigated control. In the one water treatment (W_1) one inch of effective water has been applied when the soil moisture deficiency is 1·8 inches below field capacity and in the other treatment (W_2) the same quantity of water has been applied when the deficiency is 1 inch. Tests carried out on the experimental plots have shown the mean field capacity of the soil to be 5·32 inches. The idea behind these treatments is that W_2 represents the first point to be irri-



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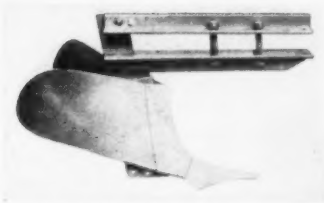

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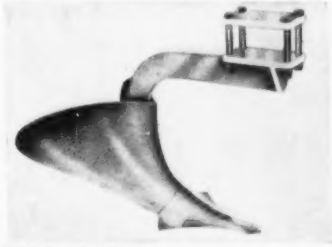

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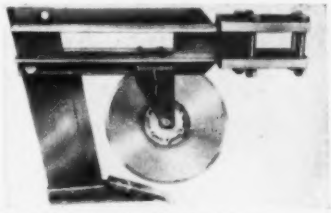

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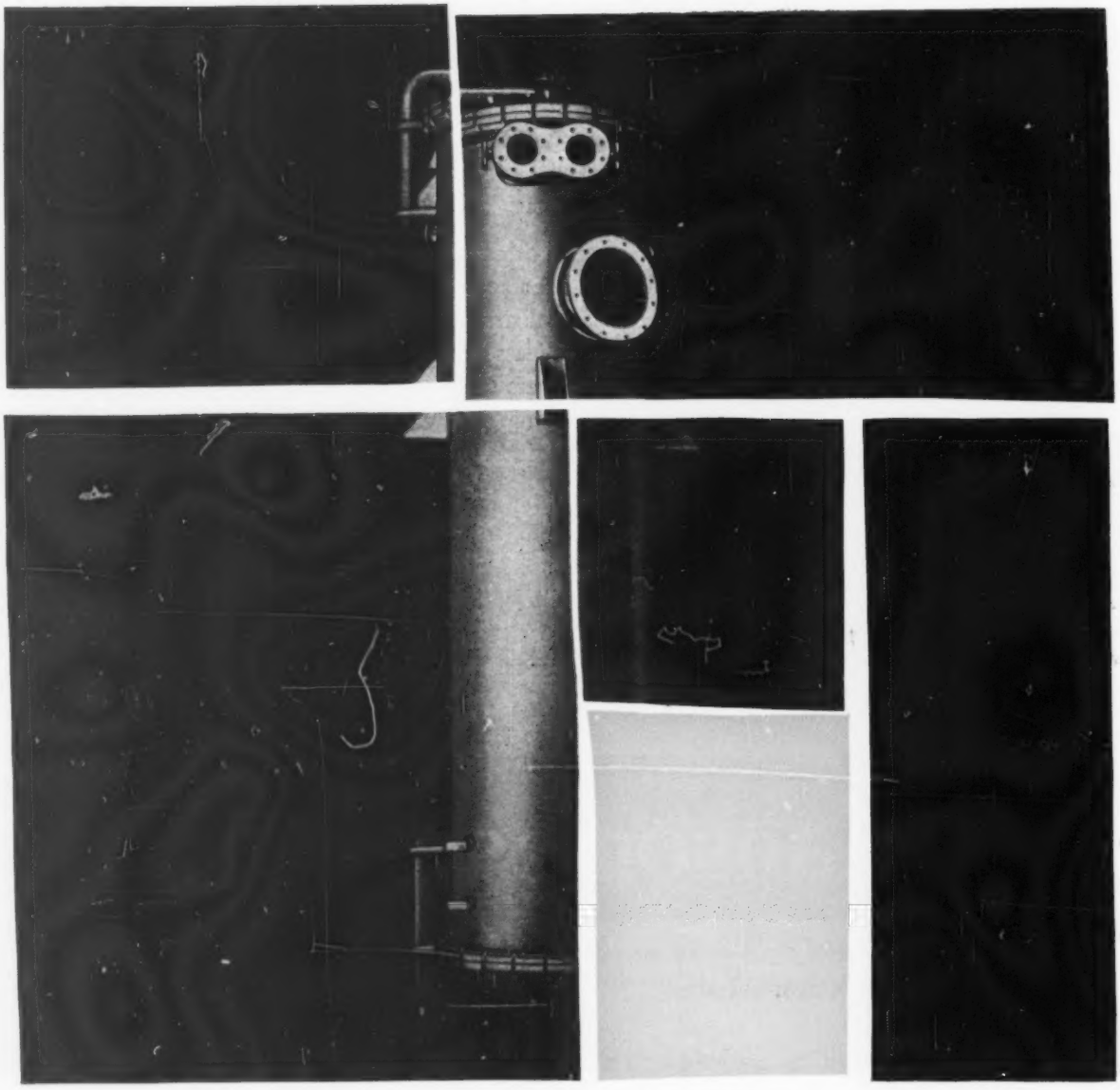

gated according to the control system in this paper, and W_1 represents a point in the scheme which receives water when the soil moisture is halfway between field capacity and wilting point. This experiment has a very practical bearing on irrigation control. It has a factorial design with 3 levels of water × 3 levels of nitrogen × 2 levels of phosphate × 3 levels of potash. THOMPSON's results for the plant cane crops harvested at 23 months are shown in Table VII.

Table VII

Results of Illovo Experiment, Variety N:Co 310

Treatment	*Rain in*	*Irrigation in*	*Yield t.c.a.*	*Sucrose %*
W_0 no water ..	79·81	—	29·15	15·81
W_1	79·81	27·93	45·48	16·93
W_2	79·81	41·23	46·54	18·25
100 lb/acre N ..	79·81	—	40·37	16·74
200 lb/acre N ..	79·81	—	40·30	16·81
300 lb/acre N ..	79·81	—	40·51	17·44
100 lb/acre P_2O_5	79·81	—	41·27	17·12
200 lb/acre P_2O_5	79·81	—	39·51	16·88
No potash	79·81	—	34·89	16·76
100 lb/acre K_2O	79·81	—	41·65	17·18
200 lb/acre K_2O	79·81	—	44·65	17·05

The following conclusions can be drawn from the results of these two experiments.

(i) The response to irrigation, which is not necessarily the most economical form of irrigation, has been large enough to justify extensive irrigation of the type described in this paper. (See Table III.) The mean response to applications of water varying from 14 to 41 inches in the experiments, is of the order of 20 tons per acre or approximately 60% of the yield under dry land conditions. Furthermore, in 1957 and 1958 the rainfall has been above average.

(ii) The time taken to grow tonnages of cane which are economical to cut is substantially reduced by irrigation. The Tongaat experiment has been cut at 21, 13 and 18 months and the irrigated plots have averaged 48 tons per acre.

(iii) The Illovo experiment indicates that if the soil moisture deficiency is maintained by irrigation below 1·8 inches (W_1 treatment) there is no significant fall off in yield.

(iv) The Tongaat experiment shows a significant response to frequency of application of water in the plant cane crop and second ratoon. In actual practice it would be unpractical and uneconomical to design an extensive scheme with a 7 day cycle. The mean response over the three crops to irrigation on a 7 day cycle compared with a 14 day cycle is 5·0 tons cane per acre.

(v) The sucrose % cane has been increased by irrigation in both experiments. The plots have been dried off before harvesting and at Illovo the Clements Crop-log moisture index has been extensively used as a guide to pre-harvest ripening. CLEMENTS recommends that the sheath moisture should be reduced from 82 to 73% over a period of several months. The explanation of the increased sucrose is undoubtedly the fact that irrigation enables the cane to remain in good condition during the winter drought and therefore make sucrose. The Illovo experiment was accidentally burnt at harvest and THOMPSON attributes the high sucrose to desiccation due to the intense heat. When the moisture content of the cane is adjusted to a common value there is still a substantial increase in sucrose % with cane irrigation. The figures are:—

W_0 = 15·2%
W_1 = 15·7%
W_2 = 16·6%

(vi) The experiments suggest that the economical level of nitrogen to apply to irrigated ratoon cane is between 100 and 200 lb N per acre. Rather surprisingly, this is not more than the most economical level for cane growing under dry land conditions. Neither the plant cane crop of the Tongaat or Illovo experiment showed a significant response to nitrogen.

(vii) The Illovo experiment has shown linear response to potash and a spectacular potash-water interaction which is extremely interesting. Because of this THOMPSON[2] suggests that the true response to water is only given by examining the K_2 plots. In this case the response to irrigation when potash is not limiting is:—

Water level	*Tons cane/acre*	*Sucrose %*
W_0	31·02	15·73
W_1	50·47	17·16
W_2	52·47	18·27

Further irrigation experiments will be necessary to establish the most economical level or system of irrigation. To this end, a trial has been planted at Tongaat to study the response to 1 inch of effective water applied when the soil moisture, calculated from evaporation data and rainfall, reaches 1·0, 1·5, 2·0, 2·5, 3·0 and 3·5 inches below field capacity. Experiments of this nature in conjunction with studies described by PEARSON in his paper to this conference, should give a great deal of information.

In conclusion, a feature of irrigation at Tongaat which has given rise to some concern, is the degree of puddling, run-off and compaction which has been observed when large rainers apply 1 inch of water in 1 hour. The run-off is particularly bad on hillsides of middle ecca shale. This observation, coupled with reports from America[3] and other countries on the material advantages of slow precipitation from small low-pressure rainers, has started a new line of thought and action at Tongaat which is worth mentioning although it is still in the experimental stage.

Nearly 800 acres of flat or gently undulating land have been put under irrigation using long lines of small sprinklers operating at a pressure of 30 to 40 p.s.i. These rainers are spaced at 40 ft × 60 ft and precipitate either 0·25 inches or 0·18 inches per hour. From 40 to 50 small rainers are used to replace one large one and the lines remain in one position or set for 4 to 6 hours, depending on the precipitation rate which gives a total precipitation of 1 inch.

[3] GRAY: "Value of slow application of water by sprinkling". National Rainbird Sales and Eng. Corp. Publication, Azusa, California, U.S.A.

The capital cost of installation is slightly higher with the low pressure rainer schemes owing to the amount of portable piping and stand pipes required. This has been kept to a minimum by replacing 4 inch aluminium pipes by 2 inch galvanized ones and using a home-made device to keep the 9½ ft tall stand-pipe vertical. The power required for the small rainers is less than for the larger ones owing to their lower operating pressure. This is important in view of the vital rôle played by the cost of power in the development of extensive irrigation schemes in Natal.

Low pressure sprinklers have been particularly successful in the 350-acre factory effluent disposal scheme. The gentler precipitation on ground which is sometimes already very wet is one advantage, but in particular, the bugbear of changing rainers at night is overcome by leaving them for 12 hours; that is from 6 p.m. to 6 a.m., when the effective precipitation is only 2 inches. During the day two changes are made and at the end of an irrigation round the field is credited with 1½ inches of water. Two units of labour are used with each set of small rainers. A set of small rainers consists of 3 lines of 40 to 50 rainers each. Two lines are spraying while the third is being changed. This has been done to economize in the amount of equipment used, but it would be better to have four lines and change two lines at a time. One unit of labour could handle this during the day shift.

It is much too early to be dogmatic about recommending small rainers for the irrigation of sugar cane. The decision will depend on further experience and the result of a comparative test between the two systems. There is no doubt that small rainers have many advantages, some of which have been mentioned. Another definite advantage is the more uniform distribution of water where wind is a problem due to the fact that a 10% overlap can be allowed. Suffice it to say at this stage that small rainer schemes are worth considering by anyone contemplating putting sugar cane under irrigation.

Prominent Coimbatore cane varieties. V. G. DESAI. *Sugar J.* (La), 1961, **23**, (9), 19–20.—A historical review is given of the important Co varieties bred at the Sugar Cane Breeding Station since its inception in 1912.

* * *

How to handle frozen stand-over cane. ANON. *Tucumán Agric. Exp. Sta. Circular*, 1960, (160), 8 pp.—Four alternative suggestions are advanced and certain varietal responses are given in illustration.

* * *

Phosphorus in soil organic matter. N. J. BARROW. *Soils and Fertilizers*, 1961, **34**, 169–172.—The latest work on the nature of organic phosphorus in the soil and on its reactions under different soil conditions is reviewed.

CANE AGRICULTURE IN CUBA

IN the first of the agricultural papers read at the 33rd Annual Conference of the Association of Sugar Cane Technologists of Cuba in 1959, C. B. CUETA R. pointed out that 2 year old stand-over cane is more heavily infected by borer than normal ratoons and that the crop brought to harvest is composed very largely of 1 year old, and immature suckers.

Two papers dealt with the varietal position; the first by A. L. FORS, giving a general historical survey of the plant-breeding programme and G. DOMINGUEZ L. a survey of the work being conducted at the Jovellanos Sugar Experiment Station. R. BARRETO D. *et al.* briefly recorded in tabular form a varietal comparison of commercial canes grown at that Station and harvested in 1959.

A. L. FORS gave a detailed, illustrated account of a tractor-mounted tank designed to apply hot-water treatment to seed cane. The additional cost of planting is estimated to be between $1.50 and $1.75 per cordel. In a final paper L. C. SCARAMUZZA gave an account of his impressions gathered during the 1959 meeting of I.S.S.C.T.

H. M.-L.

AGRICULTURAL ABSTRACTS

Studies on the *Phytophthora* rot of sugarcane seed pieces in Louisiana. T. VAN DER ZWET, I. L. FORBES and R. J. STEIB. *Plant Dis. Reptr.*, 1960, **44**, 519–523; through *Plant Breeding Abs.*, 1961, **31**, 2340.—A virulent isolate identified as *Ph. megasperma* was found on the recently released variety CP36-13. Tests on 24 varieties grown commercially in Louisiana showed a number of them to be fairly resistant, CP48-103 being the most resistant.

* * *

The interpretation of nutritional diagnostic analyses of sugar cane in British Guiana. H. EVANS. *Sugar J.* (La.), 1961, **23**, (9), 8–16.—The consequences of accepting the fact that "optimal mineral nutrition" is but one of the factors controlling growth are followed up. In British Guiana, with its high, and often saline, water table, rainfall becomes an imimportant direct and indirect controlling factor and the sum of the 4 weeks' rainfall prior to plant analysis is taken as a better measure of soil moisture conditions. The interaction between rainfall, growth and the content of the major nutrient elements, as determined by foliar diagnosis, is discussed from this aspect. It is concluded that the factor of optimal mineral nutrition is now as closely controlled as is possible, and attention is being diverted to an investigation of other limiting factors.

SOIL REJUVENATION WITH CRUSHED BASALT IN MAURITIUS

Part I—Consistent results of world-wide interests

By O. D'HOTMAN DE VILLIERS

IT is now 25 years since the writer, from the classical studies of N. CRAIG and P. HALAIS on the soils of Mauritius at the Sugar Cane Research Station as well as from his own work on the soils of Highlands S.E. and annexes carried out at the same Institution, *concluded* that the extremely impoverished free soils of the superhumid regions of the island, which were giving comparatively mediocre responses to liberal doses of N.P.K., could be rejuvenated by application of adequate quantities of crushed basalt, the *mother* rock from which almost all the soils of the colony are derived. Full theoretical exposition was first published in the local *Revue Agricole*, 1937, **16**, 89–92.

The first open field experiments with crushed basalt laid out on approved statistical lines (two trials consisting each of two 4 × 4 Latin Squares) were planted in 1938 at Hermitage (Belle Rive) where the annual rainfall is about 135 inches so that the soil there is the totally leached out, acid residuum composed mainly of hydrous oxides of iron, aluminium and titanium, with comparatively very little silica.

The results of all these carefully conducted trials, with doses of basalt from 10 to 90 tons per acre, were fully given and discussed in two papers[1, 2] reviewed at some length by Dr. MARTIN-LEAKE in the *International Sugar Journal*[3, 4]. It is therefore merely necessary to recall that crushed basalt conclusively proved its capacity for very significantly increasing cane yields of POJ 100, M 27/16 and M 134/32 under heavy or under normal fertilization with N.P.K. In other words, the *response* of the basalted soil to chemical fertilization, using the current salts together with phosphatic guano, had been very significantly increased. In addition, the writer obtained a significantly positive effect of increasing doses of crushed basalt on juice quality in several instances and this, it can be stated today, was strikingly corroborated by a six-year experiment in large pots with POJ 2878 and Co. 301.

In view of all the consistent evidence accumulated during 11 years from pot and open field experiments and from laboratory studies, and seeing that breaking and crushing basaltic rocks on the spot to a powder of suitable fineness could be done cheaply, assuming very large quantities are crushed, the author, in 1947, induced Dr. HARRY EVANS, Ph.D., of the Research Station, to lay out new experiments for checking purposes. "A 3 × 2 × 2 factorial experiment was laid out at Hermitage consisting of 3 levels of basalt dust, viz.: none, 91 and 182 tons per acre in all combinations with normal estate fertilization and twice the normal estate fertilization and with the varieties M 134/32 and M 63/39[5]."

EVANS and the writer left the Colony but S. M. FEILLAFÉ, also of the Station, took over the matter and, every year, published in the Annual Reports the results of another carefully conducted field trial, and the figures for five crops are condensed in the Report for 1952[6].

	tons per acre		
Crushed basalt	0	91	182
Plant cane	31·9	33·6	36·3
1st Ratoon	26·7	29·8	32·6
2nd ,, ...	32·4	34·2	37·3
3rd ,, ...	33·0	36·2	38·1
4th ,, ...	33·7	38·4	41·4
Total for five crops	157·7	172·2	185·7

Thus, a statistically highly significant gain of 28 tons of cane was obtained over five crops as a result of an application of 182 tons of crushed basalt on two cane varieties. It should be pointed out that the fertilization, on the average, was well above normal and, in addition, at planting, the notable quantities of filter-press cake, farmyard manure, final molasses and ashes applied must have substantially masked the effect of basalt, at least for the first one or two crops. This was pointed out by FEILLAFÉ.

Anyway, the notably greater *response* of the basalted soil to the fertilizers applied, predicted by the writer since 1937, is once more very evident. And FEILLAFÉ, who was able to follow such a correctly laid out trial for five successive years, stated that it was reasonable to suppose that still more infertile soils would give even more "spectacular" results, and that it could be inferred from the trend of the figures that a response to basalt could safely be expected for many more years to come.

Subsequently the Research Station passed from Government to the Planters, and is now the independent Mauritius Sugar Industry Research Institute under the able direction of Dr. P. O. WIEHE, C.B.E., D.Sc.

In 1955 the Institution laid out a new field experiment at Rose Belle (Cascade) for measuring the

[1] *Rev. Agric.* (Mauritius), 1947, **26**, 160–175.
[2] *ibid*, 1949, **28**, 124–134.
[3] *I.S.J.*, 1948, **50**, 90–91.
[4] *ibid.*, 1950, **52**, 117–118.
[5] 18*th Ann. Rpt. Mauritius Sugar Cane Research Sta.*, 1947, 42–48.
[6] 23*rd Ann. Rpt. Mautirius Sugar Cane Research Sta.*, 1952, 19–20.

effect of four levels of crushed basalt, viz: none, 45, 90 and 180 tons per acre, once again under heavy fertilization and, furthermore, with the variety B 3337 which, like POJ 100 used by the writer in his very first Latin Squares, is adapted to poor soils. Here are the results[7], unpublished figures for 3rd Ratoon being added by the writer:

	tons per acre			
Crushed basalt	0	45	90	180
Plant cane	15·5	23·1	27·9	31·1
1st Ratoon	39·2	44·8	47·1	49·6
2nd Ratoon	32·7	36·9	37·9	36·5
3rd Ratoon	37·3	39·7	41·2	44·0
Total gain in four crops		19·8	29·4	36·5

The writer could not desire more powerful experimental evidence of his thesis and predictions. For plant cane ("virgins") the increase in yields due to 180 tons per acre crushed basalt reaches the 100% mark. Such a demonstration, as well as *all* the other statistically significant results accumulated during the past two decades, are not only of the highest interest to agricultural science, but they evidently are of practical value, especially on a small island where a rapidly growing population is causing the gravest concern to the authorities. Whether the effect of basalt in the soil is physical or chemical or both, would be rather immaterial to the economist to whom the substantial gains in yield, repeatedly obtained for years, is all that really counts; provided the preparation, transport and application of the rock dust are not prohibitively expensive.

Such is the consistency in uniformity of the results obtained with different levels of fertilizer applications in four different first grade field trials distributed in space and time, with five different varieties of cane, that it can safely be estimated that about 150 tons per acre crushed basalt of the degree of fineness used should, on the impoverished soils in question, give an additional 3/4 tons of sugar per acre per year, on the average, for a long series of annual cane crops.

There are, at present, more than 20,000 acres under cane on the senile yellow soils in the super-humid regions of Mauritius, which practically never suffer from drought. Furthermore, even larger areas (Crown lands) could be opened up not only for extension of cane cultivation, but also for growing many other food stuffs so greatly needed in the serious demographic conditions of the Colony.

To begin with, early in 1936, tomato plants were very successfully grown in pure crushed basalt exclusively fertilized with nitrogen. Soon afterwards was started a series of pot and open field experiments with oats, millets, soya beans all exclusively fertilized with nitrogen. Without exception, the results were very conclusive. Soya beans, on small plots to which about 150 tons per acre of crushed basalt were applied, gave an increase in yield as high as 427% for a *first* crop.

H. EVANS[8] in pots with Hermitage soil and basalt under fertilization with nitrogen grew oats with highly significant results. S. M. FEILLAFÉ[8] also used oats to demonstrate that basalt was effective in the senile yellow soil *but not* in the rather rich soils under lesser rainfall; nitrogen and phosphorus being supplied to each and every pot.

In Germany, it can be recalled, pine seedlings on very poor soils treated with 70 tons per acre of basalt waste gave, after 23 years, 4–5 *times* greater volume of timber than on untreated plots, as revealed by R. ALBERT[9]. H. H. HILF[10] calls basalt sand the "enduring fertilizer" which is readily yet sufficiently slowly weathered so that when scattered in large quantities (about 1 cm thick) over unproductive sand soils, it improves their fertility, deciduous trees being helped more than conifers. More recently, A. NĚMEC[11] of Czechoslovakia also obtained, in the space of two years, with spruce trees, striking results from large doses of crushed basalt on degraded forest lands.

Incidentally, it was the wish and advice of a Sub-Committee of the Society of Chemists in 1948 in Mauritius, that sylvicultural experiments on a suitable scale should be carried out in the Colony.

In conclusion, in addition to sugar cane it is seen that forest trees and food stuffs can also strikingly benefit from large doses of crushed basalt on poor soils. It seems, therefore, that it is now up to public and/or private enterprise to examine the economic possibilities of a question which should arouse renewed interest in the agricultural world.

AGRICULTURAL ABSTRACTS

Inoculation of sugar cane plants with mosaic virus using the airbrush. J. BIRD. *J. Agric.* (Univ. Puerto Rico), 1961, **45**, 1–7.—The "airbrush" devised by LINDNER and KIRKPATRICK[13] is found to be a more efficient tool than the Matz pin in securing infection.

* * *

Further studies on transmission of the causal agent of chlorotic streak. J. BIRD. *J. Agric.* (Univ. Puerto Rico), 1961, **45**, 8–18.—Healthy sugar cane grown in conjunction with diseased cane or Napier grass in white quartz sand, became diseased. The causal agent appears to be identical for both plants.

* * *

Progress report on cultivation practices at Central Aguirre Sugar Co. W. BARNES. *Sugar J.* (La.), 1961, **22**, (8), 19–22.—The major development described is a combined mould-board plough and subsoiler used for sugar cane banking. It makes possible the deep placement of N.

[7] *Mauritius Sugar Ind. Research Inst. Ann. Rpt.*, 1958, 81.
[8] 21*st Ann. Rpt. Mauritius Sugar Cane Research Sta.*, 1950, 27.
[9] *Forstarchiv*, 1936, **13**, 158–162.
[10] *ibid.*, 1937, **13**, 113–116; 1938, **14**, 93–102.
[11] *Soils & Fertilizers* (Imp. Bureau Soil Science); 1948, (1629), 341; 1950, (1940), 312.
[12] *Rev. Agric.* (Mauritius), 1948, **27**, 155–162.
[13] *Phytopath.*, 1959, **49**, 507.

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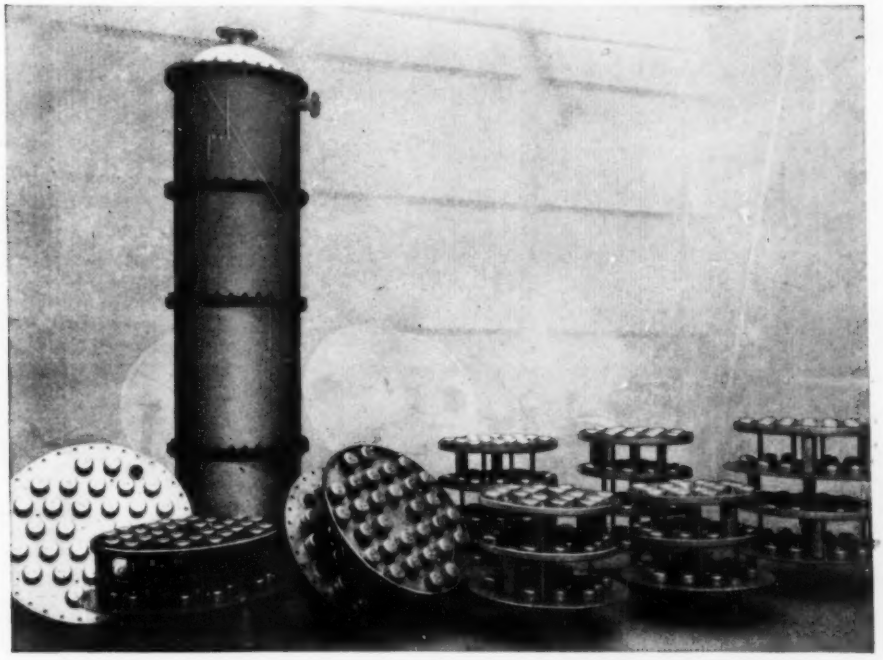

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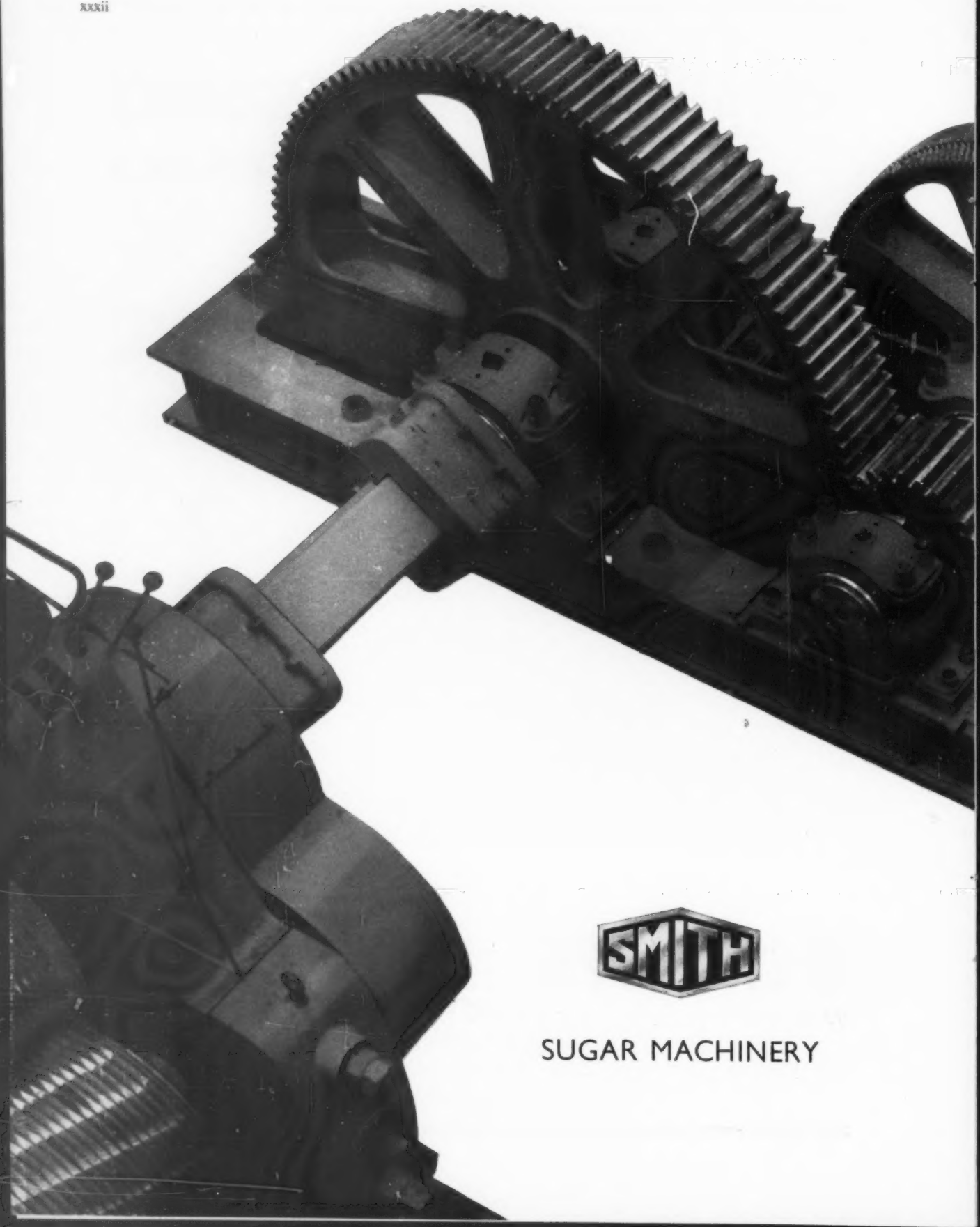

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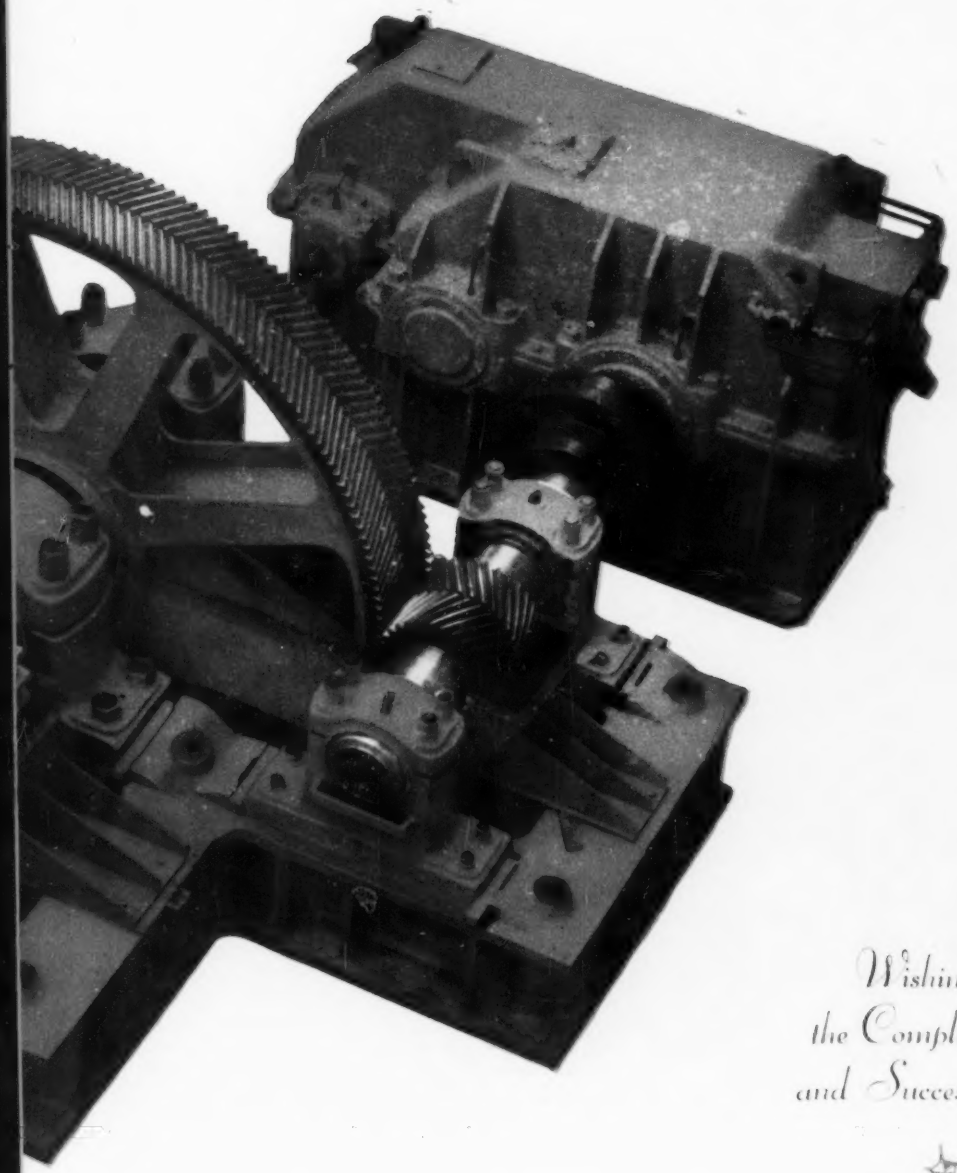

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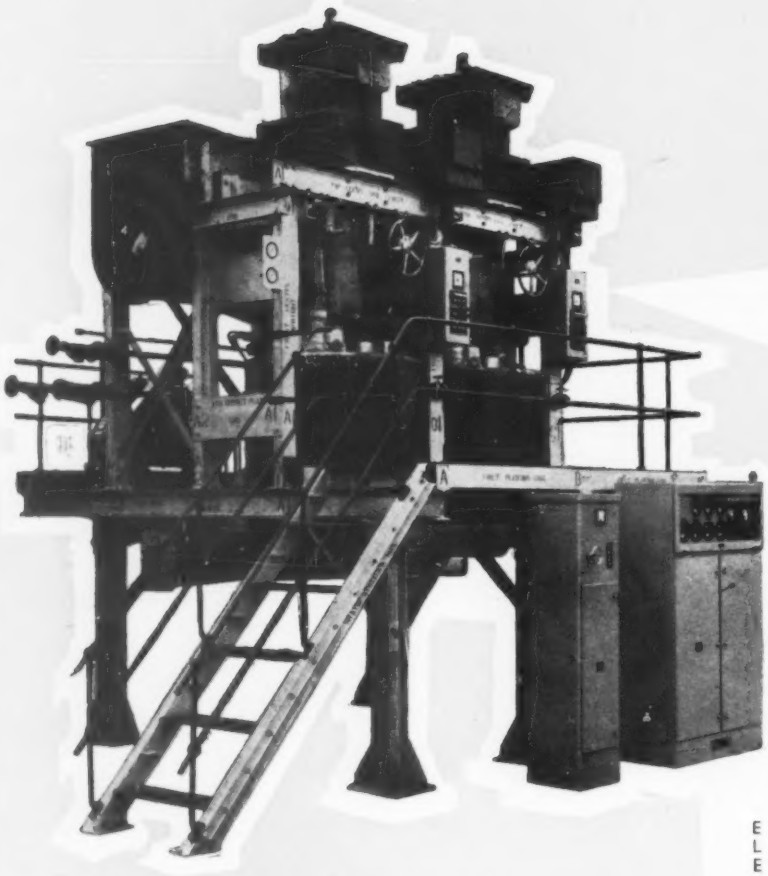

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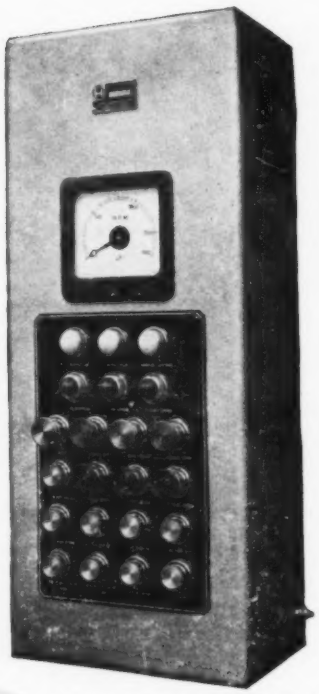

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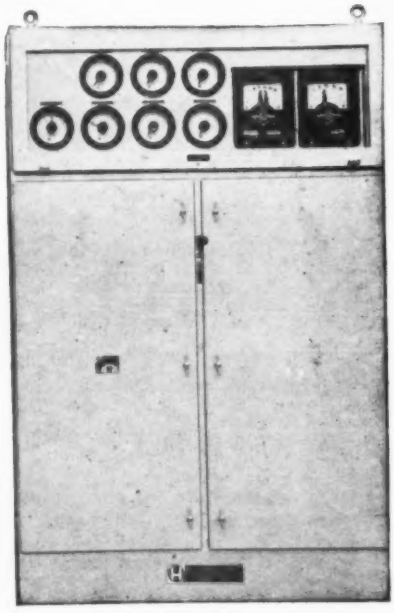

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Study of the tissue reaction to low temperatures and the assessment of frost resistance in sugarcane. M. VIJAYASARADHY. *Indian J. Sugarcane Res. Devel.*, 1960, 5, 49–53; through *Plant Breeding Abs.*, 1961, 31, 2337.—In investigations on 24 Co canes, 9 *Saccharum spontaneum* clones, 2 POJ varieties and 1 north-Indian type at the Sugarcane Breeding Institute, Coimbatore, Madras, varietal differences were found in the effects of treating (1) single-bud setts and (2) sett shoots six to eight weeks old for five days at 3°–5°C, the *S. spontaneum* canes exhibiting the greatest susceptibility. The change in osmotic concentration of the cell sap was determined in sett plants exposed to a temperature of 3°–5°C for 120 hr at the age of 5–6 weeks. Using $CaCl_2$ as the plasmolysing agent and neutral red as the stain to indicate incipient plasmolysis in the pith and chlorenchyma, varietal disparities were detected in the change in osmotic concentration, as indicated by the difference between the maximum value recorded for a variety at the end of the treatment and the corresponding control value. Canes in which the change after 120 hr ranged from 0·12 to 0·15 M, 0·07 to 0·11 M, and 0·03 to 0·06 M, were considered to be resistant, moderately resistant, and susceptible to cold, respectively.

* * *

Certain adaptive characters of genetic stalks of *Saccharum spontaneum* L. tolerant to water-logged conditions. K. SRINIVASAN and J. T. RAO. *Curr. Sci.*, 1960, **29**, 321–322; through *Plant Breeding Abs.*, 1961, **31**, 2338.—Out of 28 clones of *S. spontaneum* tested at the Coimbatore Sugarcane Breeding Institute, two clones, SES334 and SES340, were found to perform best under waterlogged conditions. They were characterized by the production of a large network of fibrous roots and a number of negatively geotropic roots coming to the water surface. It is suggested that these two clones may serve as suitable genetic donors of tolerance of waterlogged conditions in the breeding of sugar-cane varieties. The same characters were also found, though to a lesser degree, in five other SES clones, 267, 278, 279, 351 and 367.

* * *

Sugar cane mosaic vector studies in Louisiana. L. J. CHARPENTIER. *Sugar Bull.*, 1961, **39**, 222–225.—With the release of N:Co 310 and CP 52-68—two highly susceptible varieties—and the appearance of a new strain of mosaic, the possibility of crop failure, such as occurred in the mid-twenties, has to be faced. A record is given of observations on the relative abundance of the aphid vectors on areas of heavy and light infection respectively.

Cytological studies in Saccharum and allied genera. S. PRICE. *Hawaiian Planters' Record*, 1960, **56**, 183–194.—Chromosome number determinations, made by the author, of 69 clones of which 45 noble canes have not been previously reported, are included in a tabular statement covering all recorded observations.

* * *

A promising parasite for the control of the internode borer. S. A. RAJA RAO. *Indian Sugar*, 1961, **10**, 703.—The borer, *Proceras indicus*, has developed into a major pest in certain areas of S. India. In 1958 *Aprostocetus israeli* was introduced from Bombay with a view to controlling the top borer. In this it had small success but, in the areas of release, exercised notable control of the internode borer.

* * *

Sugar cane research in Telegana (Andhra). S. K. SASTRY and A. V. CHARI. *Indian Sugar*, 1961, **10**, 705–711.—Detailed tabular analyses are given of factorial design fertilizer experiments with ranges of N, P and K, as also of monthly plantings, both Adsali (June to September) and Eksali (November to February) plantings, each with monthly harvesting (October to January).

* * *

Insect pests of sugar cane in Bihar, Part 2. D. K. BUTANI. *Indian Sugar*, 1961, **10**, 649–654, 765–768, 779–781.—These articles cover the major pests of sugar cane and, in each case, the bionomics, extent of damage and the control measures are briefly recorded.

* * *

The Louisiana sugar beet story. R. J. STEIB. *Sugar Bull.*, 1961, **39**, 210–212.—An account is given of the history of growing beet in Louisiana since the idea was first propounded by Dr. W. C. STUBBS in 1886. Trials in 1955 are quoted as evidence that beet might, with the new varieties now available, prove a profitable crop when autumn planted.

* * *

Timely and frequent irrigation. J. N. DAWE. *Spreckels Sugar Bull.*, 1961, **25**, 18.—This is the first of a series of articles in the May/June issue dealing with irrigation of the beet crop in its various aspects.

* * *

Louisiana sugar cane variety census, 1961. L. P. HEBERT. *Sugar Bull.*, 1961, **39**, 236–238.—CP 44-101 still leads in all areas at 38% of the area but it is being replaced by N:Co 310 (25%) and CP 52-68 (12·5%). Of other varieties grown none occupy more than 7% of the total area.

THE CALCULATION OF MILL DELIVERY SETTINGS

By C. R. MURRY* and J. E. HOLT†
(Dept. of Mechanical Engineering, University of Queensland.)

MANY attempts have been made to calculate mill delivery settings such as that made recently by CHIRGWIN[1] whose paper may be compared with HUGOT[2] Chapter 13. CHIRGWIN erroneously assumes that the density of fibre varies down the crushing train.

The theoretical bagasse height, i.e. the work opening if there were no reabsorption, can be simply calculated.

Let q_f be the mass of fibre per unit width of roll. Then the volume of fibre is $\frac{q_f}{d_f}$ where d_f is the fibre density. If the fraction of fibre in bagasse (by weight) is F then the mass rate of juice per unit width is $\frac{1-F}{F} q_f$ and the volume rate $\frac{1-F}{F}\frac{q_f}{d_j}$ where d_j is the density of juice in bagasse. Hence the total volume rate per unit width is $q_f\left(\frac{1}{d_f}+\frac{1}{d_j}\cdot\frac{1-F}{F}\right)$ whence, if the roll surface speed is S, the height of the bagasse W_n leaving the mill if it were moving at speed S is given by

$$W_n = \frac{q_f}{S}\left(\frac{1}{d_f}+\frac{1}{d_j}\cdot\frac{1-F}{F}\right).$$

This equation is represented by the nomogram Fig. 2 where the density of fibre is assumed as 1·53 g per ml. Work carried out by PIDDUCK[3] shows that this value does not vary significantly with pressure.

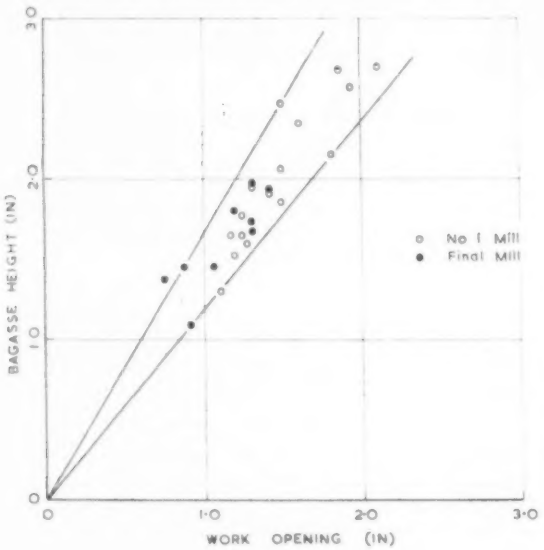

Fig. 1

It is well known that the volume of bagasse leaving the mill is in excess of the escribed volume[4, 5, 6, 7]. We expect, therefore, that the bagasse heights obtained from the nomogram will be in excess of the actual mill work openings. Work openings reported by Queensland mills in the 1959 season are shown in Fig. 1 compared with theoretical bagasse heights. Results from mills with dirty top rollers are not included since there is difficulty in determining the effective work opening. The slopes of the lines in Fig. 1 are 1·65 and 1·18 and these slopes represent the range of "reabsorption factor" under Queensland conditions.

Work carried out in experimental mills in Queensland[6, 7] has shown that the reabsorption factor is higher at high mill speeds, coarse preparation and high weight of fibre per unit escribed volume.

SAMPLE CALCULATION

HUGOT[2] uses the following problem as an example of calculated delivery openings. We will solve this problem using the nomogram of Fig. 1.

It is required to calculate the operating delivery openings for a train of 11 rolls, 28 × 54 in, handling 32·5 tons of cane per hour at 13% fibre with roll *surface* speeds of 29·4 ft per min for the crusher and 25·7 ft per min for the mills. Following HUGOT it is postulated that the mills are to be set to obtain bagasses of 25, 37, 45 and 50% fibre respectively. We will also assume that the Brixes of the juices in these bagasses are 20, 20, 11 and 8 respectively.

The fibre rate per foot is $q_f = \frac{32{\cdot}5 \times 0{\cdot}13 \times 2240}{60 \times 4{\cdot}5}$ lb per min per ft = 35·0 lb per min per ft.

From the nomogram the theoretical bagasse heights are 0·80, 0·60, 0·49 and 0·43 inches respectively. These may be compared with HUGOT's values of 0·77, 0·58, 0·47 and 0·42 inches respectively (HUGOT assumes juice densities somewhat higher).

* Sugar Research Institute Fellow.
† Colonial Sugar Refining Company Research Officer.

[1] *Sugar J.* (La.), 1960, **23**, (3), 27–31; *I.S.J.*, 1960, **62**, 350, 352.
[2] Handbook of Cane Sugar Engineering. (Elsevier, Amsterdam.) 1960. p. 165.
[3] *Proc. 22nd Conf. Queensland Soc. Sugar Cane Tech.*, 1955, 147–155; *I.S.J.*, 1956, **58**, 259.
[4] EGETER: *Archief*, 1928, **36 II**, 691–729; *I.S.J.*, 1929, **31**, 265.
[5] BULLOCK: "An Investigation into the Crushing and Physical Properties of Sugar Cane and Bagasse." *Ph.D. Thesis* (Univ. Queensland), 1957.
[6] CRAWFORD: *Proc. 10th Congr. I.S.S.C.T.*, 1959, 100–111; *I.S.J.*, 1961, **63**, 86.
[7] MURRY: *Elec. Mech. Trans. Inst. Engineers Australia*, **EM2**, (2).

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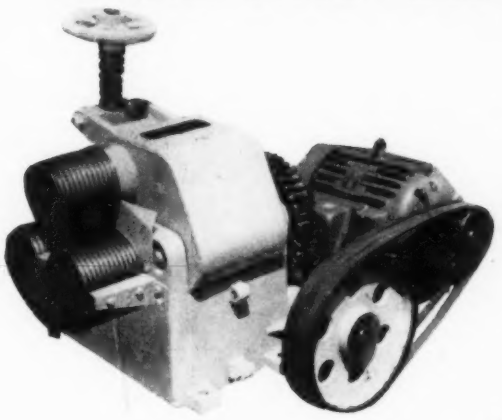

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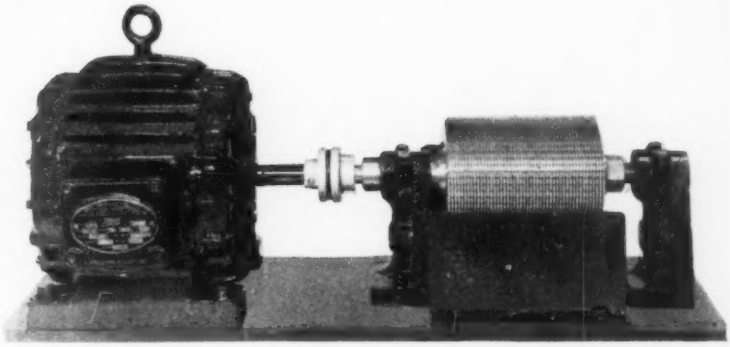

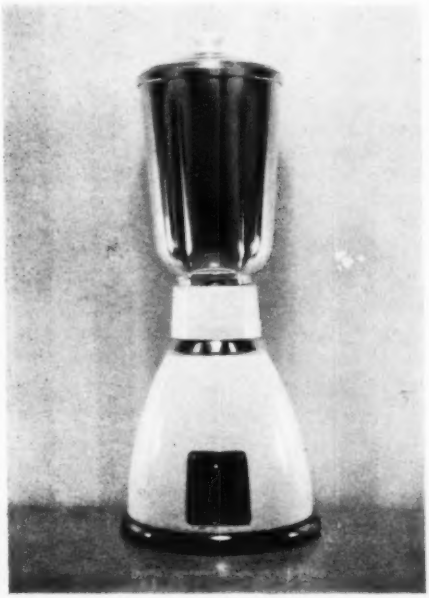

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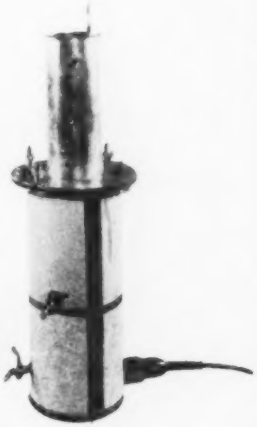

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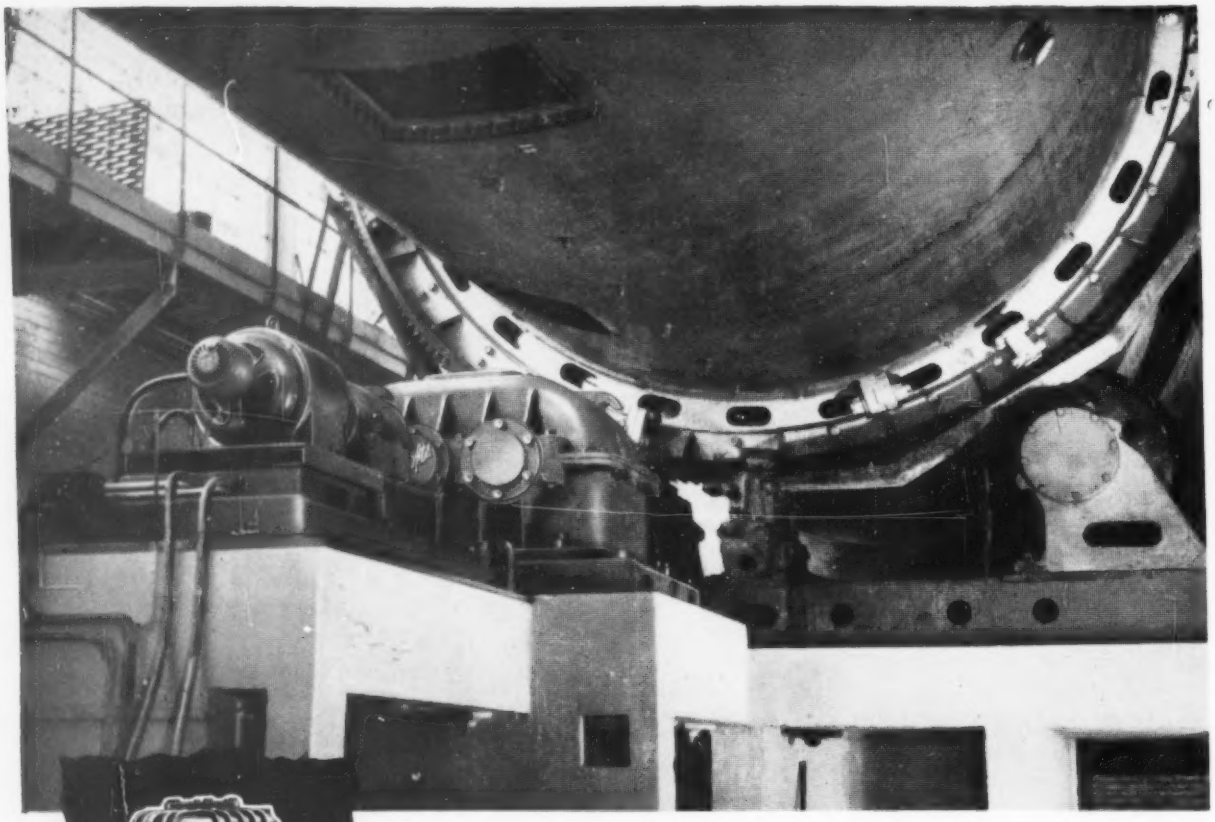

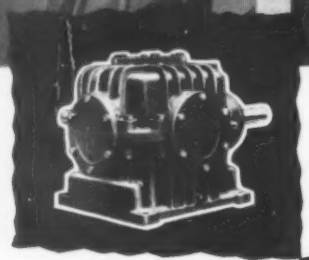

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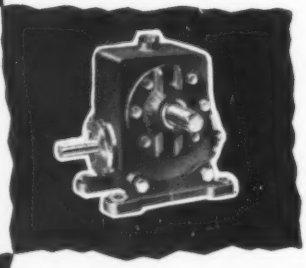

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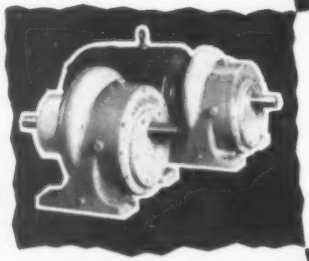

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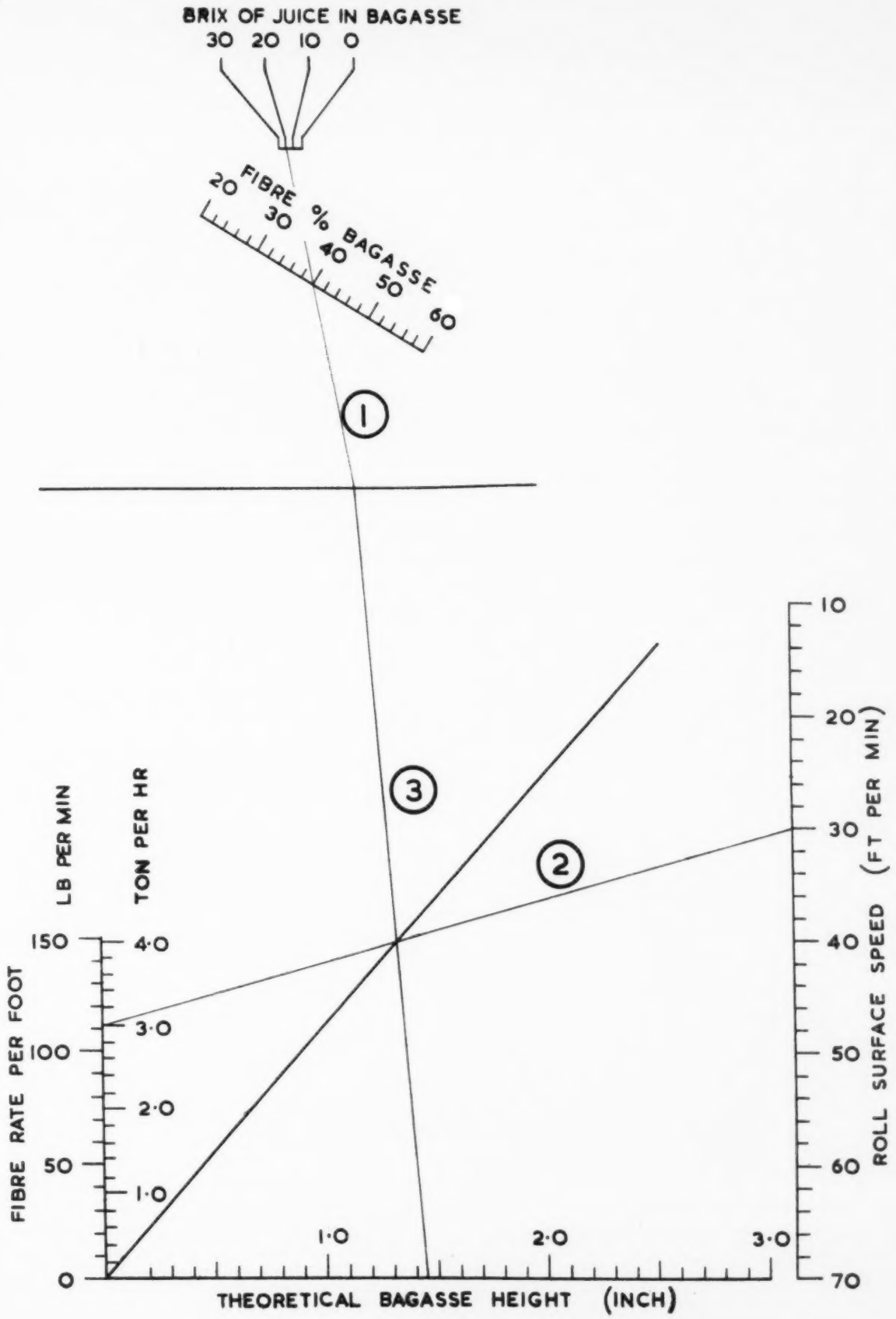
BRIX OF JUICE IN BAGASSE
30 20 10 0
FIBRE % BAGASSE
20 30 40 50 60
1
2
3
FIBRE RATE PER FOOT
LB PER MIN
TON PER HR
150
100
50
0
4·0
3·0
2·0
1·0
1·0
2·0
3·0
THEORETICAL BAGASSE HEIGHT (INCH)
ROLL SURFACE SPEED (FT PER MIN)
10
20
30
40
50
60
70

Fig. 2

From the analysis of Queensland mill results it is suggested that each of these values should be divided by a reabsorption factor of 1·3 to obtain the operating mill delivery opening. The resulting values are 0·62, 0·46, 0·38 and 0·33 in or $^{5}/_{8}$, $^{15}/_{32}$, $^{3}/_{8}$ and $^{5}/_{16}$ in approximately.

Conclusions

The ease with which practical results can be obtained from the nomogram is obvious. The only doubt arises in the selection of a suitable reabsorption factor and it is suggested that the mill engineer should calculate these factors for each of his units from existing data or from analysis of bagasses.

Acknowledgments

The authors wish to acknowledge the particular assistance given by the following Queensland Sugar Mills: Farleigh, Qunaba, Millaquin, Kalamia and North Eton, all Queensland Mills for permission to use data from the Mutual Control sheets, and Mr. H. M. Finucan of the Mathematics Dept. of the University of Queensland for advice on the construction of the nomogram.

ADSORPTION BY BONE CHAR USING A CONTINUOUS ADSORPTION PROCESS (CAP)

By WILLARD MARCY, Ph.D.

Division Head, Process Development, Research and Development Division, The American Sugar Refining Company

Paper presented at the Twentieth Annual Meeting, Sugar Industry Technicians Inc., 1961.

PART II

Desugaring Column

The liquor-char slurry is next filtered on a top-feed rotary vacuum deliquoring screen to separate the carrier liquor from the bone char. The liquor recovered is recycled to the washed sugar liquor stream. The bone char drops from the filter through the single soaking tube of the desugaring column to be desugared by an upward flowing stream of hot water. The water inlet spargers near the bottom of the column and the sweetwater removal system at the top of the column are similar to those of the liquor inlet and removal systems in the decolorizing column.

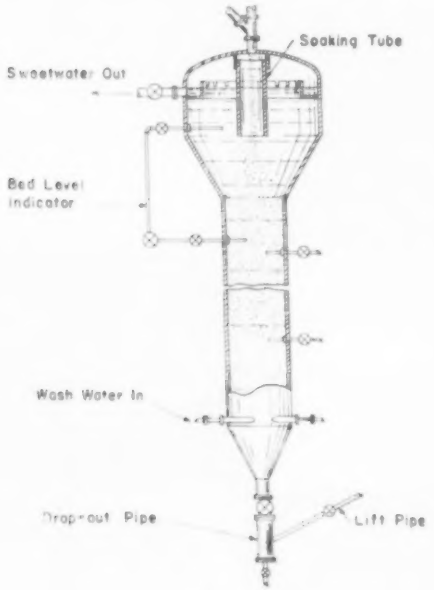

Fig. 6

Since the rate of desugaring is very rapid, only one desugaring column of 3½ ft diameter is required to handle all the bone char from three 12 ft diameter decolorizing columns (Fig. 6).

Desugaring is accomplished with a minimum amount of water, the ratio of water to char being of the order of one-half volume of water, or less, per volume of char. A continuous flow of high purity sweetwater of about 30° Brix is produced from the top of the desugaring column.

Spent char is discharged from the desugaring column in a water slurry, and char bed height is determined and controlled by methods similar to those used in the decolorizing column. The slurry is fed to the top of the de-ashing column without dewatering.

De-ashing Column

The de-ashing column is of the same size, design and construction as the desugaring column and is operated in a similar manner.

Wash water enters near the bottom of the column and passes upward through the downward moving char, removing the inorganic impurities and carrying them through the top outlet of the column to waste.

The de-ashed char slurry discharged from the bottom of the column is fed to a top feed rotary

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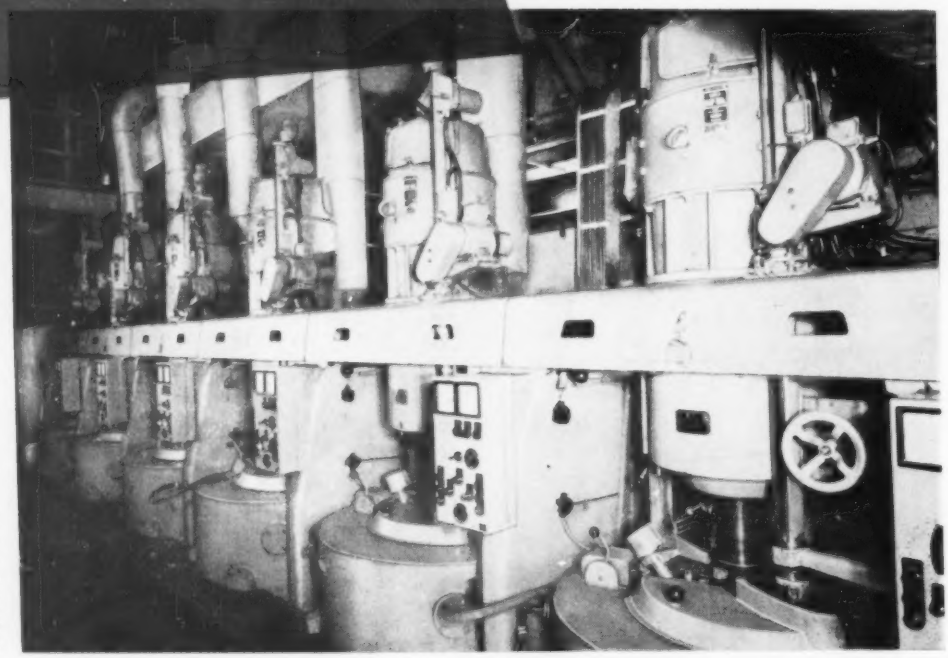

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vacuum dewatering screen where, by suction and hot air drying, the moisture content of the char is reduced to 20% or less.

Reactivation

The dewatered char is fed to the top of a multiple-hearth kiln where it is reactivated in a low oxygen atmosphere. The char is cooled, screened and conveyed back to the top of the decolorizing column, thus completing the adsorbent loop of the process.

Control Instrumentation

Primary control of the CAP system is provided by instrumentation in the refinery central control room. Liquor and water flow rates, bed levels and kiln controls are all located here. Additional knowledge of the process is provided by recorders for oxygen content of flue gases, total adsorbent flow and sweetwater production.

Some of these controls are duplicated at the CAP site, and additional information, such as bed levels, kiln hearth temperatures and flow rates are recorded or indicated.

Labour Requirements

The entire CAP system is located outdoors about 300 ft from the central control room. The system is under the direct operating control of the control room operator. However, an area operator can be called quickly to make minor adjustments on the kiln or other CAP equipment. Experience has shown that such attention requires only about half the time of the area operator.

Technical Results

Colour Removal

The CAP system has such flexibility that any desired colour removal can be obtained at will, since any granular adsorbent suitable to treat sugar and any ratio of liquor to adsorbent can be used.

Cuban, Puerto Rican, Hawaiian and San Domingo sugars have all been treated successfully either in the pilot plant studies or at the Bunker Hill Refinery. In the pilot plant, sugars were pretreated by either of two methods: (1) simple liming to neutral pH followed by press filtration, or (2) phosphatation followed by flotation clarification. At Bunker Hill only phosphated and clarified liquors have been processed. In the pilot plant both new and service bone chars were used. At Bunker Hill the liquors have been processed through essentially a service bone char, some of which had been transferred from the old Boston Plant.

Typical overall colour removal data at different liquor to bone char volume ratios are given in Table II. It is quite evident that several factors can be varied to obtain any desired product colour. The depth of the bed, determined by original design criteria, also contributes to the overall colour removal capacity of the decolorizing unit. Since all these factors can be varied over wide ranges, CAP enables the refiner to tailor his processing methods instantly, and with a high degree of precision, depending on the raw sugar used, to yield a uniform quality product at minimum operating cost.

Table II

Colour Removal

Liquor to adsorbent vol. ratio	*Type of Pretreatment*	*—% colour removed— Pretreatment*	*CAP Decolorizer*	*Overall*
A. Service bone-char:				
4·0/1	None	—	94	94
	P–C	28	89	92
6·0/1	None	—	92	92
	P–C	40	84	90
8·0/1	None	—	88	88
	P–C	42	83	90
12·0/1	None	—	87	87
B. Twice regenerated new bone-char:				
6·0/1	None	—	94	94

Note.—P–C is phosphatation followed by flotation clarification.

On the basis of both pilot and commercial plant data, it appears certain that high quality granulated sugar products can be produced using no more than 10 to 15 pounds of bone char per 100 pounds of melt, about half that normally used in conventional stationary bed char cistern operations.

Ash Removal

The CAP system is effective in removal of the ash from either untreated or pretreated washed raw sugar solutions (Table III). In both pilot plant and commercial plant operations 45 to 50% of the ash present in the liquor fed to the char has been adsorbed.

Table III

Ash removal and desorption

	Pilot Plant	*Commercial System*
Total ash adsorbed by bone-char in decolorizer (% of total fed)	45 to 50	45 to 50
Adsorption of individual ions in the decolorizer (% of total fed):		
Calcium	90 to 95	90 to 95
Sulphate	90 to 95	90 to 95
Magnesium	60 to 70	60 to 70
Sodium	Essentially none	Essentially none
Potassium	Essentially none	Essentially none
Ash desorbed in desugaring (% of adsorbed ash)	60 to 70	Essentially none

Essentially all the calcium and sulphate ions are adsorbed and about two-thirds of the magnesium ions. Sodium and potassium ions are only slightly adsorbed, if at all. Adsorption of chloride and phosphate ions has not been studied as yet.

Although about 60 to 70% of these ions were desorbed in the desugaring column in the pilot plant, essentially no ash desorption in the desugarer has been experienced in the commercial unit. This results in a net loss of ash in the refining operation as most of the ash is desorbed to waste in the de-ashing column. Since little ash is recycled in the sweetwater, the char sweetwater is exceptionally high

in purity, 99·0 to 99·5%, and is used directly for melting raw sugar.

Invert Balance

Some decrease in reducing substances, calculated as invert, in the decolorizing column is apparent.

A reducing substance balance struck around the entire CAP system, including desugaring, shows essentially no overall gain. Chemical inversion on CAP, therefore, does not appear to be a problem.

pH Changes

In both pilot plant and commercial CAP systems no net change in pH of the treated melt stream occurs under normal operating conditions.

The pH values of the product liquors and sweetwaters vary depending on the pH of the water extract of the adsorbent. However, with bone char the greatest amounts of decolorization and ash removal appear to occur if the feed liquor pH is 7·4 or above. The pH of the product liquor is influenced by that of the freshly reactivated bone char fed to the decolorizer, and thus could be quite high. With multiple-hearth kiln reactivation this has not been a problem.

Sweetwater pH values generally range between about 6·7 and 7·5.

Sucrose Losses

In both pilot and commercial plant operation, sucrose balances have shown that there appears to be no net loss of sucrose, either chemically or mechanically, within the precision of measurement.

A continuous sugar detector monitoring the waste stream from the de-ashing column gives warning of unusual, small losses. Adjustments in either quantity or temperature of the wash water to the desugaring column are then easily and quickly made to eliminate such losses.

Bone Char Quality and Usage

Since only high purity sugar liquors are presented to the bone char in the CAP system at Bunker Hill, the entire adsorptive capacity of the adsorbent is probably not used. However, unlike conventional stationary bed operation, every adsorbent particle is exhausted to the same extent. The subsequent washing and reactivation treatment is, therefore, easier and less drastic than is generally the case in usual refining practice. Consequently the adsorbent is not subject to extreme chemical and thermal stresses and will undoubtedly have a longer life. It is too early to determine whether this is so, but the rate of increase in bulk density in the commercial CAP plant appears to be slower, to date, than is normally experienced in a standard char system.

The normal criteria for judging char quality, lye test, sulphate, sulphide and carbonate contents, have all been within the ranges considered proper for good char.

Since multiple-hearth kiln reactivation has been used, the carbon content of the char has been controlled by adjusting the oxygen content of the flue gases. No difficulty has been experienced to date in doing this.

Although some mechanical degradation of the bone char was expected in the slurry handling system, tests in the pilot plant indicated that this would be minor, if present at all. Sufficient time has not yet elapsed to judge this in commercial practice.

Soft Sugars by CAP

Experimental data indicate that soft sugar liquors can be treated by CAP to yield commercial soft sugars. Here again, more efficient char usage, greater processing flexibility, and more uniform quality product are obtained.

This system was omitted from the Bunker Hill design for reasons unrelated to CAP. However, it is contemplated that as additional char installations within The American Sugar Refining Company are made, they will include the treatment of soft sugar liquors as well as melt liquors by CAP.

ECONOMICS OF THE CAP SYSTEM

1. Direct Savings.

A. Capital Investment.—Since the CAP system, including reactivation equipment, is simpler and smaller than a conventional char system, and outdoor installation could be conveniently used, a saving in capital investment of at least 50% was realized at Bunker Hill.

B. Operating Costs.—The entire CAP system, including reactivation, can be operated by about half an operator per shift. This is a saving of about 90% in operating labour over a modern conventional char system, and even more than this over the char houses presently operated within the Company.

Fuel costs for reactivation are reduced by about 50% due to the lower rate of bone char usage.

A saving of at least 50% in maintenance and repairs is also expected.

C. Bone Char Inventory Reduction.—A reduction in char inventory of about 75% is effected by CAP, thus releasing capital funds for other income producing uses.

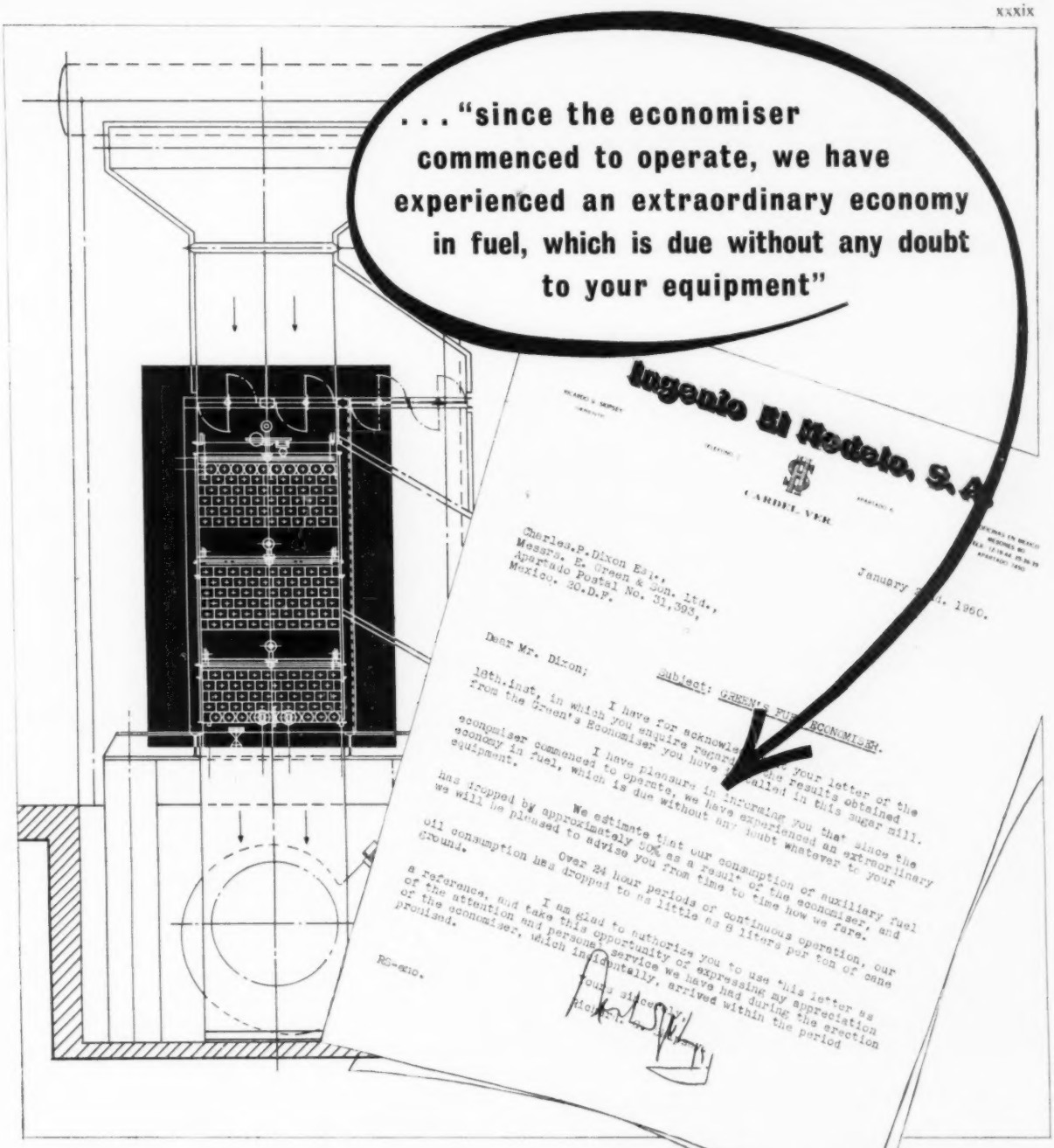
D. Reduction in In-Process Inventory.—The use of the CAP system results in a reduction of about 80% in in-process liquor inventory. This releases additional capital funds for other uses.

2. Associated Savings.

A whole host of associated savings is visualized. The most obvious of these savings are:

A. Improved Product Quality.—Without CAP, the old Boston Plant frequently used powdered activated carbon for producing low colour granulated sugar. With CAP at Bunker Hill added carbon is unnecessary.

B. Greater Sugar Extraction and Reduced Quantity of Remelt Boiling.—Since a consistently high quality decolorized washed sugar liquor is obtained from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economiser commenced to operate, we have experienced an extraordinary
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oil consumption has dropped to as little as 8 litres per ton of cane
ground.
I am glad to authorize you to use this letter as
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of the economiser, which incidentally, arrived within the period
promised.
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Yours sincerely,

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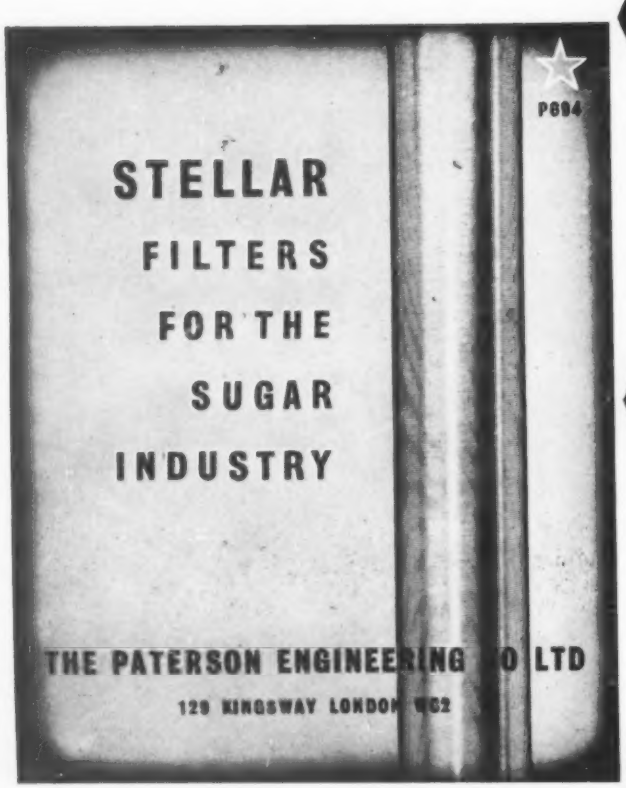

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CAP a larger amount of first strike sugars relative to second and third strike sugars has been obtained. Since fewer melassegenic impurities are present, less sugar is carried to remelt and fewer remelt boilings are required. Elimination of more non-sugar solids also results in the production of less blackstrap.

C. Reduced Recycling of Liquors and Sweetwater.—With CAP no char treatment of granulated syrups is necessary.

The reduced amount and high quality of the sweetwater produced enables all the char sweetwater to be used directly for melting raw sugar without evaporation and recycling to char treatment.

The reduced quantity of remelt sugar can easily be handled by direct addition to the melt stream without special reprocessing.

The reduced recycling leads to both lower chemical losses and reduced size of processing equipment.

D. Greater Flexibility.—With the CAP system raw sugars unusually difficult to refine are easily handled by simple adjustment of the liquor to adsorbent ratio.

E. Reduced Bone Char Usage.—The greater efficiency of bone char use in the CAP system results in a reduced bone char usage. This, in turn, reduces water and steam costs for desugaring and deashing.

F. Easier Maintenance of Good Sanitation.—The CAP area is much easier to keep clean than is a conventional charhouse.

Other Applications

CAP has already been licensed and is being applied commercially to the treatment of beet sugar liquors using Pittsburgh CAL carbon as adsorbent.

There seems no apparent reason why CAP could not be extended to the treatment of any sugar-bearing solution, including corn syrups. Likewise, CAP could be adapted to the use of any granular adsorbent normally used to treat sugars.

Conclusion

CAP as installed commercially has met the major objectives of providing a continuous, automatically controlled purification step for the sugar refiner at reduced capital investment and operating cost.

Specifically it has: (1) minimized capital investment; (2) minimized operating, and maintenance and repair costs; (3) provided a continuous, automatic, versatile purification process; (4) improved product quality; (5) minimized the use of adsorbent; and (6) minimized production of sweetwater and upgraded sweetwater quality.

THICK JUICE STORAGE

By V. I. MORRIS

(Holly Sugar Corporation, Colorado Springs, Colo., U.S.A.)

THE daily slicing capacity of the Carlton beet sugar factory of the Holly Sugar Corporation, located in the Imperial Valley about midway between Brawley and El Centro, California, has been substantially increased by the construction of facilities pertinent to the adoption of a processing procedure which is somewhat of an innovation in the sugar industry.

The extremely high temperatures which are experienced in the Imperial Valley make it imperative that the crop of beets be harvested in the relatively short period of time between April 1 and July 20 in order to ensure, on the one hand, that mature beets are available for processing, and on the other, that serious deterioration of the crop as a result of the high temperatures be avoided.

In the past, processors of beets grown in the Imperial Valley have been able to operate only during the period of the beet harvest, since beets cannot be stored in such a climate as that of the Imperial Valley. As a matter of fact, only a sufficient tonnage of beets is harvested each day for the Carlton plant as is necessary to ensure capacity operation until the beet dump opens on the following morning.

The agricultural and climatic restrictions mentioned above made it impracticable for Holly to increase the beet acreage in the Imperial Valley substantially unless additional processing facilities were provided to accommodate such increase. The potential acreage increase did not appear to be such as to justify the construction of a completely new plant of sufficient capacity to ensure economical operation comparable to that currently being obtained at the Carlton plant; therefore, other solutions were considered.

Some experimental investigation of a process for drying "cossettes" and storing them for future processing had been carried out previously. The investigation was terminated, however, as being economically unsound, since such a process would require incredibly large storage facilities, and, too, the problem of reprocessing the dried material presented too many difficulties.

Holly then returned to consideration of the storage of "evaporator thick juice." Some experimental work had been started as early as 1944, and although the procedure appeared, at that time, to be practicable, advantage had not been taken of the information then obtained. The experimental work later continued at the Santa Ana and Carlton plants of Holly on a much larger scale during the campaign operations of 1958 and 1959 had proved that the purified and concentrated beet liquor (evaporator thick juice)

could be stored in quantity for a reasonable period of time without deterioration. In these experiments the unfiltered juice, at the temperature at which it came from the evaporators, was stored in uncoated steel tanks previously utilized for molasses storage. This stored juice was processed after the completion of beet slicing with no more difficulty than was experienced during the normal day-to day operation. As a result of this work it was apparent that the desired goal could be achieved by the expansion of only a portion of the plant from the beet end to the evaporators, and by providing suitable storage for the concentrated thick juice which would be accumulated during the normal slicing period and processed into granulated sugar after the slicing was completed.

Fig. 1. Carlton sugar factory, showing five storage tanks in the foreground, bulk sugar storage, factory buildings, and beet storage in the background.

The new facilities were designed to increase the former slicing capacity to 6000 tons of beets per twenty-four-hour period on the premise that the concentrated evaporator thick juice from 2400 tons of beets would be stored, while the juice from the remaining 3600 tons would be processed in the conventional manner.

In order to handle the desired additional beet tonnage efficiently, the following equipment and facilities were added:

One 42 in Beet Dump—Scale House, and two 50-ton Scales
Beet Storage—over flumes for 2000 tons of beets
Two Beet Slicers
One 2500-ton DdS Slope Diffuser
One Gas Fired Lime Kiln
One First Carbonatation Station (2500-tons capacity)
Three Vacuum Filters (Direct filtration of first carbonatation juices)
One Sextuple Effect Evaporator Station
Four Automatic Thick Juice Filters
Six Tubular Heat Exchangers
Five Storage Tanks
One Package Boiler (70,000 lb steam/hour)
One Pulp Dryer—complete with pulp presses (3000-ton capacity)
Dried Pulp Storage
Auxiliary equipment, such as tanks, pumps, controls, instrumentation, etc.

Full advantage was taken of the original installation where existing capacity was ample for the new requirements.

The entire flow of the beets (6000 tons per day) is flumed into the factory as one stream, elevated and discharged into a single hopper which feeds the six slicers. Approximately 3600 tons of beets are processed through the original Silver chain-type continuous diffuser, and the remainder through the new 2500-ton DdS slope continuous diffuser. The raw juice from the chain diffuser passes through the original carbonatation and Dorr thickener, while the raw juice from the new slope diffuser is treated in the new first carbonatation station and clarified by direct filtration with rotary vacuum filters.

The two streams of first carbonatation juice are then combined and processed in the new second carbonatation system, followed by filtration and sulphitation. The juice flow is split at this point and a sufficient amount to maintain the sugar end at capacity production is concentrated in the original evaporator station and processed into granulated sugar, while the remainder of the flow is concentrated to approximately 70° Brix in the new sextuple effect evaporator. The concentrated evaporator thick juice is then heated, filtered, and finally cooled to within about ten degrees of ambient temperature. It is then pumped to storage.

In general the storage conditions for evaporator thick juice are the same as those required for satisfactory storage of liquid sugar. Tabulated below are the storage conditions observed during the first year of operation. There appears to be no justification

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The customer states ". . . it is beyond any doubt that the two accumulators . . . have to a very considerable extent helped in attaining this remarkable achievement".

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for altering these conditions for future storage operations.

1. The tanks for storage should be well sterilized immediately prior to being used.

2. The thick juice to storage should be as sterile as possible and filtration is advised to remove spores not killed by heat.

3. Thick juice should be cooled to as near ambient temperature as possible before being pumped to storage in order to minimize condensation on the sides and top surfaces of storage tanks while they are being filled.

4. The Brix or Dry Substance of the evaporator thick juice should be as close to saturation as possible, depending on its purity. Surface crystallization is desirable.

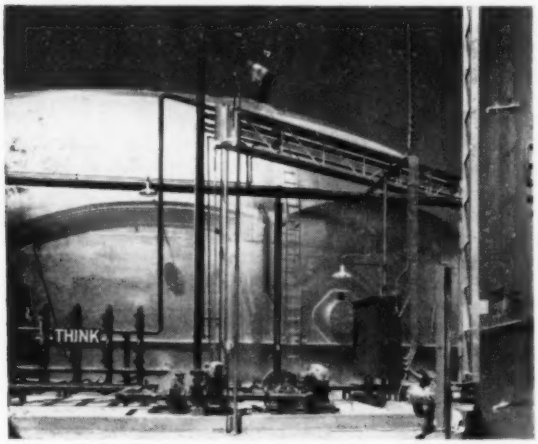


Fig. 2. Close-up of one of the storage tanks, showing piping manifold, pumps and controls.

5. The pH should be as high as possible to avoid optimum conditions for microbiological growth.

6. Storage tanks should be constructed so that there is a minimum exposed surface of juice when tanks are full.

7. Filtered air circulation should be provided in storage tanks to help prevent condensation.

The storage tanks which are 102 ft in diameter and 48 ft 9 in high at the top of the ellipsoidal roof have a capacity of 1,850,000 gallons each, or a combined capacity of the five tanks in excess of 9,000,000 gallons. The tanks have a flat bottom which has a slope of one foot in its diameter towards the point of outlet which is near the circumference. After erection, the interiors of the tanks were first sand-blasted, after which three coats of an epoxy resin were applied. The exterior surfaces of the tanks were given a coating of aluminium paint to reflect solar heat.

The unique design of these tanks is necessary in order to eliminate the air space at the top so as to avoid condensation which would result in surface dilution, and possible deterioration as a result of bacterial infection. The tanks were cleaned and sterilized before the thick juice was introduced. Tanks were completely filled, leaving no air space by providing an overflow to a small tank, common to all of the storage tanks. Any overflow was immediately returned to the plant for reprocessing. Any air inhaled by the tanks passes first through an electrostatic precipitator which removes spores, yeast, and dust. Samples of the juice from all tanks were analysed daily for Brix, purity, pH, invert, and colour. Lactic acid analyses were performed at weekly intervals to determine possible bacterial contamination.

Evaporator thick juice was stored throughout the duration of the beet slicing period which extended over 110 days. There was no apparent deterioration in the quality of the juice during the storage period. The sugar end capacity was somewhat in excess of our previous estimate, and as a result, only four of the five tanks were utilized for storage this year.

Immediately following the completion of beet slicing, the processing of the stored juice was started. The juice was transferred from the tanks to the plant, utilizing variable speed, positive displacement pumps which handled the cool rather viscous liquor very satisfactorily.

The original design conditions of the Carlton plant were aimed at achieving the near ultimate in fuel economy. The turbo-generator provides exhaust steam to the quintuple effect, long tube, film-type evaporators at a pressure of 50 p.s.i. The vacuum pans are all of the calandria type. The white, intermediate, and low raw pans are heated by first, second, and third vapours, respectively. Such an installation lends itself very favourably to the further processing of the stored thick juice.

During the thick juice run, the first and second effect evaporators were boiled upon water (any make-up consisting of "Zeolite"-treated water and excess condensate) to provide vapours for vacuum pan boiling. The thick juice was returned to the fourth and fifth effects for necessary heating. These bodies were operated at atmospheric pressure, and the heating was effected by utilization of all condensate flash plus the small quantity of first vapour required for maintaining the desired temperature.

The processing of the stored juice presented no particular problems. There was a rather wide variation in beet quality during the beet processing campaign and, therefore, a similar variance in the quality of the evaporator thick juice stored. This quality variance was reflected in the most part as a function of apparent purity, colour, invert, and lime salts. In processing the stored juice, it was interesting to note the similarity of operating results to those of the period of the beet slicing operation when the juice was produced for storage. There was a light deposition of sugar crystals on the bottom of the tanks when they were emptied, but it was not of such volume as to cause any great difficulty in removal.

The installation has fulfilled the conditions for which it was designed, i.e. to provide increased processing capacity at a fraction of the cost of a complete new factory of equivalent capacity.

Throughput and purging efficiency of a continuous centrifugal. F. PROSKOWETZ and J. C. P. CHEN. *Sugar y Azúcar*, 1961, **56**, (5), 38–40.—Cf. *I.S.J.*, 1961, **63**, 77–78.

* * *

The production of kieselguhr filter aid in the Ukraine. F. M. PASHKOVSKII, V. A. BONDARENKO and P. I. STASEVSKII. *Sakhar. Prom.*, 1961, (5), 11–15.—Details are given with a flow sheet of a scheme for production of kieselguhr from tripolites. This is intended for a factory, producing 20,000 (and eventually 30,000) tons of kieselguhr per year, which will be the first of its kind in the Soviet Union.

* * *

Rationalization of production of pressed refined sugar at Khutor-Mikhailovsk factory. F. A. DEMCHINSKII. *Sakhar. Prom.*, 1961, (5), 28–29.—Modifications include a lever system for shaking of the hopper feeding the slurry to the presses to prevent caking; a lever system for the cube ejectors which will prevent damage to the cubes and consequent large amounts of refined sugar to be returned to process; and a scheme for return of small bone char particles to production, preventing the removal of these with bone char dust in the de-dusters.

* * *

Expansion of Wanli sugar mill. T. C. LIU. *Taiwan Sugar*, 1961, **8**, (2), 28–31.—Details are given of the machinery installed in Wanli sugar factory to raise its crushing capacity from 2200 t.c.h. to 3000 t.c.h. with provision for a further increase to 4000 t.c.h. The 700-ton mill was replaced by a 1500-ton mill train from Chichow sugar factory, whence came one new evaporator and barometric condensers. One new evaporator and a low-head pan for *A* massecuite were also installed, as well as auxiliary equipment and piping. Full details are given of the equipment and of the material flow. The monetary gains resulting from the alterations are calculated.

* * *

Sanitation problems in bulk sugar handling. J. SCHOENBERGER. *Assoc. Food & Drug Official U.S. Quart. Bull.*, 1960, 75–80; through *S.I.A.*, 1961, **23**, Abs. 433.—Road and rail tank cars for the transport of bulk or liquid sugar are frequently of an unsanitary design, being similar to those used for handling non-food products. A number of examples and recommendations are given. Tanks should be self-draining and possess a smooth, non-toxic and non-corrodible surface; manholes of adequate size with permanent ladders for cleaning and inspection should be provided. Pump, valve and piping assemblies should be easily dismantled, with butt-welded permanent joints flush to the adjacent surface and with sanitary or threadless flanged connexions.

* * *

Invoicing and sales statistics with an IBM 632 electronic invoicing machine in conjunction with a punched card unit. W. LEIBIG. *Zeitsch. Zuckerind.*, 1961, **86**, 367–373.—Details are given of the IBM 632 invoicing machine and of the punched card system used at Franken sugar factory. The costs in the sales department have been cut, as well as the number of employees and the working hours.

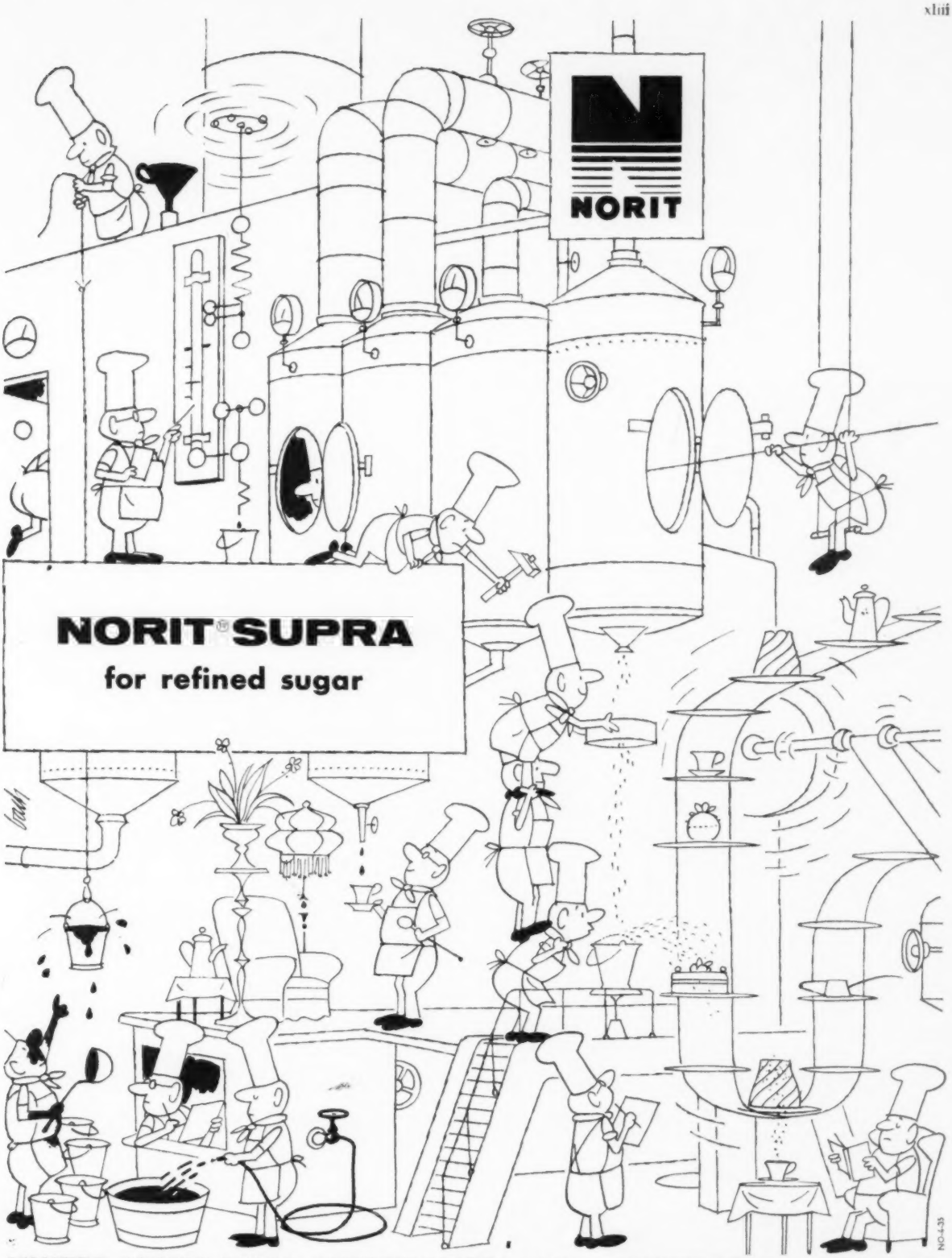
* * *

Protection and supervisory devices for suspended centrifugals[1]. W. ROJEK. *Zucker*, 1961, **14**, 303–306. Various devices for control of centrifugal operation are described. These include the "Sensotherm" thermo-electric release for protection against overloading and two-phase operation; a magnetic control for prevention of excessive oscillation; fuse protection devices; and means of protecting the power plant against peak loading, whereby the starting and discharging controls are locked. Control of the charging and discharging processes is also discussed as is the use of light signals for warning purposes.

* * *

Decolorizing ion exchangers. XV. Effect of pH of decolorized solution on the decolorizing efficiency of amphoteric exchange resin. E. ANIŠČENKOVÁ. V. VALTER and K. ČIŽ. *Listy Cukr.*, 1961, **77**, 131–137.—Tests are reported in which the effect of pH on the efficiency of "Wofatit E" was studied. Both fresh and used resin were investigated. The maximum colour absorption was in the region of acid reaction. At pH values greater than 5·5 the relative decolorizing capacity fell linearly with increase in pH, expressed by $D = a\,\mathrm{pH} + b$, where $a<0$, D = amount of colour absorbed, and a and b are coefficients describing the grade of ion exchanger, a expressing the drop in capacity of used resin. The fall in decolorizing capacity with pH rise depends on the extent of "utilization" of the resin; an equation is developed for relative decolorizing: $D = a(\mathrm{pH} - \mathrm{pH}^{\circ}) + \mathrm{const}$, where the pH has dropped from 6·66 (with a fresh resin) to 5·5 (after 5 cycles). The drop in decolorizing capacity is also dependent on the quantity of colour matter absorbed by one litre of resin during one cycle (B_o'). This may be expressed by Langmuir's equation: $\frac{dD}{d\,\mathrm{pH}} \equiv a = \frac{k_1 B_o'}{1 + k_2 B'_o}$, where $k_1 = -11{\cdot}2$ for used resin and $-13{\cdot}6$ for fresh resin, while $k_2 =$

[1] *See also* SCHERER: *I.S.J.*, 1960, **62**, 288.



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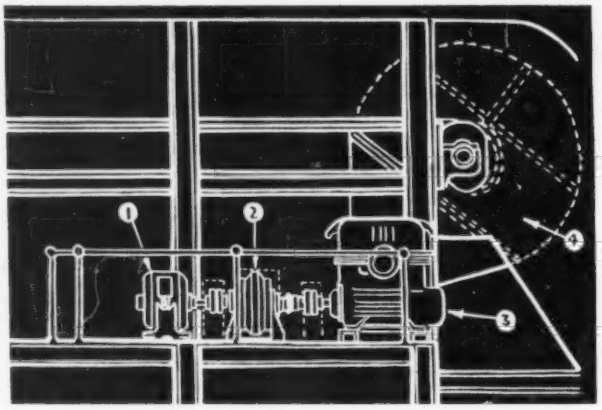
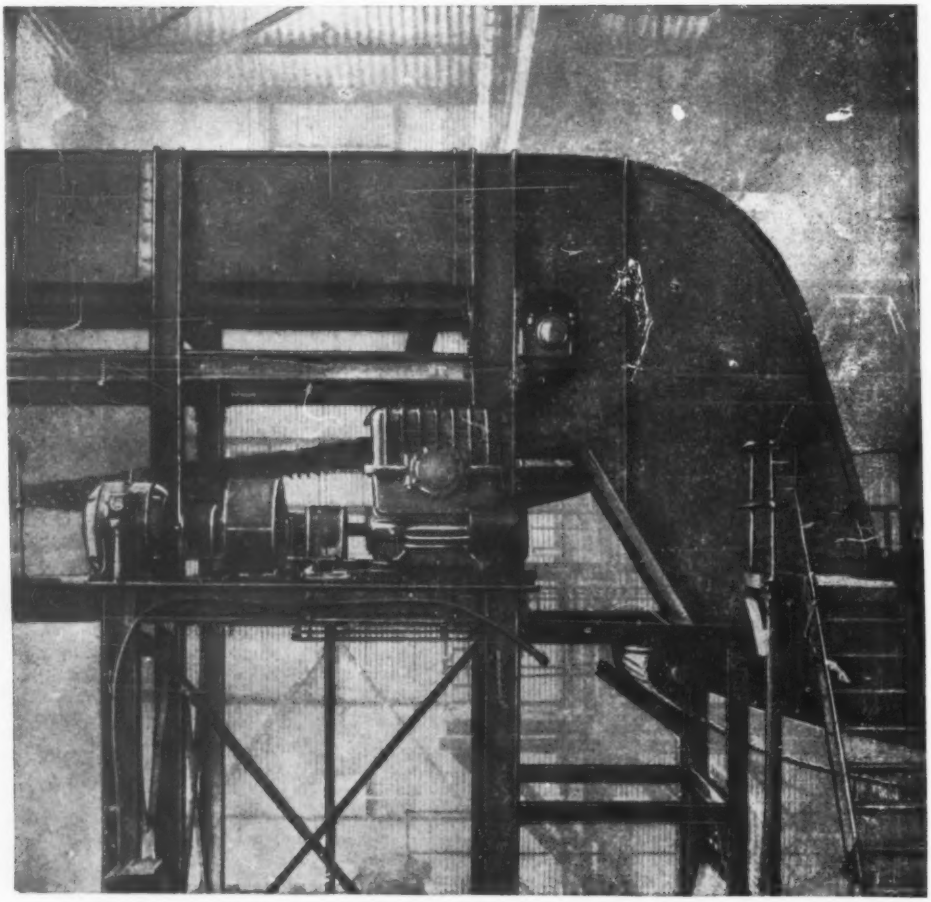


On the above diagram,

1. Squirrel cage motor.
2. Variable speed constant magnetic coupling.
3. Worm reduction gear box.
4. Spur gear.



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0·345 in both cases. The absolute values of the coefficients may differ according to operating conditions.

* * *

America's new Domino Refinery opens in Boston. THE STAFF, AMERICAN SUGAR REFINING COMPANY. *Sugar y Azúcar*, 1961, **56**, (6), 39–53.—See *I.S.J.*, 1961, **63**, 268, 300.

* * *

Technological scheme for processing of raw cane sugar at Tokmaksk sugar factory. I. A. KOIFMAN. *Sakhar. Prom.*, 1961, (6), 29.—The 3-boiling scheme used at the first factory in the Kirgiz to process cane raws has been modified to increase white sugar yield and reduce molasses yield and purity. Details of the modified scheme are given.

* * *

Low grade crystallization at Lungyen. J. C. CHOU. *Taiwan Sugar*, 1961, **8**, (3), 24–28.—The supersaturation coefficient in the low-grade station is determined with the aid of a saturation cell[1] and pan control is effected by means of a conductivity instrument consisting of 2 electrodes and milliammeter in a constant voltage circuit, the current flow being a function of supersaturation. The final massecuite is grained in molasses of 65–68 purity. A ball mill is described which is used for preparation of the seed slurry of fondant sugar in alcohol. Factory data are presented showing a drop in molasses sugar from 7·0–7·5 to 6·0–6·5/100 Bx by adoption of the control system; 80% of the final sugar is in the 14–28 mesh region.

* * *

Report on juice clarification and sedimentation experiment. S. L. SANG. *Taiwan Sugar*, 1961, **8**, (3), 29–34.—Laboratory and pilot-plant tests conducted on juice clarification are reported. The juice was taken from those mills where the introduction of RapiDorr clarifiers had not resulted in any improvements. Settling in the laboratory tests was very slow, and while dilution led to a marked increase in the initial settling rate, it produced no improvement in the mud volume. Addition of 10 p.p.m. "PMA" or 3 p.p.m. "Separan" polyelectrolytes to the hot-limed juice resulted in a significant reduction in the mud volume and increased mud concentration. The volume of the mud in the clarifiers was found to have a positive effect on clarification, the required volume being given by $V = \frac{F.C_o(t-t_c)}{C_{av}}$, where V = volume of mud-compression zone, C_o = initial concentration of juice insolubles, $(t-t_c)$ = required mud retention time in either clarifier determined by batch settling tests, and C_{av} = average mud concentration in the compression zone. Equations are also developed for calculation of the clarification area and minimum mud thickening area.

Physico-chemical and economical basis of complex processing of granulated sugar to refined sugar and caramel. S. Z. IVANOV. *Trudy Voronezh. Tekhnol. Inst.*, 1960, **16**, 99–106.—In the U.S.S.R. half of the granulated sugar produced is in the form of raw sugar which must be refined. Refining losses through sucrose degradation and resulting from the melassegenic properties of the degradation products amount to about 1%. The factors causing reduction in sucrose stability are discussed, including the effect of temperature, time, sodium carbonate used to maintain alkalinity, etc. Two refining schemes are suggested in both of which all the final run-off is used for caramel production. The syrup is not made alkaline and treated with bone char, but is treated with active carbon or ion-exchange resin. This reduces the factory equipment and will give either 60% or 80% refined sugar (on original sucrose) according as a single-boiling scheme is used or a two-boiling scheme, with the run-off from the 1st massecuite used as 2nd massecuite feed. Linking sugar refining with confectionery production is considered of utmost importance.

* * *

Modified ion-exchange process for the control of iron in sugar products. W. W. BLANKENBACH and A. P. NEILSON. *Proc. 6th Tech. Session Bone Char*, 1961, 5–30.—The ion-exchange resin mentioned earlier[2] was found in batch process to have a limited iron adsorption capacity. Because of this and high labour costs involved, a granular resin, "Verite" (consisting of sulphonated tannin compounds), which could be used in continuous processing, was developed. Details are given of the pilot plant and of the results obtained during the first year of operation of a full-scale plant of 4 columns. A 30-minute contact time was found sufficient to adsorb 70–86% of the iron present in the syrup or molasses while maintaining inversion at below 0·1% on total solids. During the first 6 months of factory operation, the iron content of soft sugars was kept below 6 p.p.m., although when West Indies raw sugar was replaced by Fiji raws the iron content of untreated liquors and syrups was found to be double (i.e. 100–120 p.p.m. as opposed to 40–60 p.p.m.). To overcome this difficulty, 4 further columns were installed. The resin is regenerated with a 3% sulphuric acid solution, any $CaSO_4$ formed and free acid being removed by washing with water. Costs of operation amount to 8·1 cents per 100 lb soft sugar. Details are given of the procedure[3] for iron determination in which a 10-ml sample is reduced to the Fe^{++} state. Addition of 0·5 ml of a 0·02% solution of α, α'-dipyridyl with 0·5 ml of 2% sodium bisulphite solution gives a red colour, which is compared with standards to give the iron content. The sugar concentration is determined from the Brix and the iron may then be calculated on a dry solids basis.

[1] *See* Laboratory Manual for Queensland Sugar Mills. 3rd Edn. (Bureau of Sugar Expt. Sta., Brisbane.) 1954. pp. 108-109.
[2] *I.S.J.*, 1953, **55**, 212.
[3] MOSS & MELLON: *Ind. Eng. Chem., Anal. Ed.*, 1942, **14**, 862–865; GRAY & STONE: *ibid.*, 1938, **10**, 415–417.

Use of highly basic resins in sugar refining. C. D. CONKLIN and A. CONGELOSI. *Proc. 6th Tech. Session Bone Char*, 1961, 31–52.—A survey is presented of anion exchange resins and their applications in refining. The use of highly basic anion exchange resins for refinery liquor decolorizing is discussed, in particular those in chloride form. Operational data are presented together with costs and details of equipment. These show that up to 70% colour removal is possible with colour levels of up to about 70 NBS units and the resins have a useful life of up to about 250–300 cycles before replacement is required. The resins are not generally as efficient as other material (bone char, active carbon) in decolorization, but their relatively low installation and running costs make their use practical as additions to the adsorbents where such treatment is justified by giving enlarged capacity or better product quality. They do have the advantage over these (except bone char) of replacing undesirable anions in the sugar liquors with chlorides. In the lighter colour ranges, they are more effective than carbons, where uneconomical amounts of the latter would have to be used. It is also mentioned that the resin can be taken to a much higher state of exhaustion than can a carbon, so that the difference in capacities between resins and carbons is not as great as between the specific efficiencies.

* * *

The significance of non-sugars for the manufacture of refined sugars. P. HONIG. *Proc. 6th Tech. Session Bone Char*, 1961, 101–120.—To judge whether a sugar liquor will yield 3 successive granulated sugar strikes more must be known about some of the non-sugars and their concentrations. Details are given of procedures used in past years, particularly in Java, to eliminate such impurities as iron, calcium, potassium, sodium and silicates. Iron is best removed by carbonatation, which will reduce the content to less than 2 p.p.m. total solids. At low concentrations of Ca in a liquor, the Ca content in the refined sugar is approximately proportional to this; but when more than 400 p.p.m. of Ca is found in the liquor, there is a substantial increase in the Ca in the refined sugar ash. While the excess Ca becomes supersaturated during crystallization and precipitates between the sugar crystals, there is no evidence of co-crystallization in the sucrose crystals. Details are given of small-scale crystallization experiments conducted in Java in 1932-1938, where for each refining technique a linear relationship was established between colour of refined sugar and the ash content. Turbidity of sugar solutions is attributed to silicic acid or silicate.

* * *

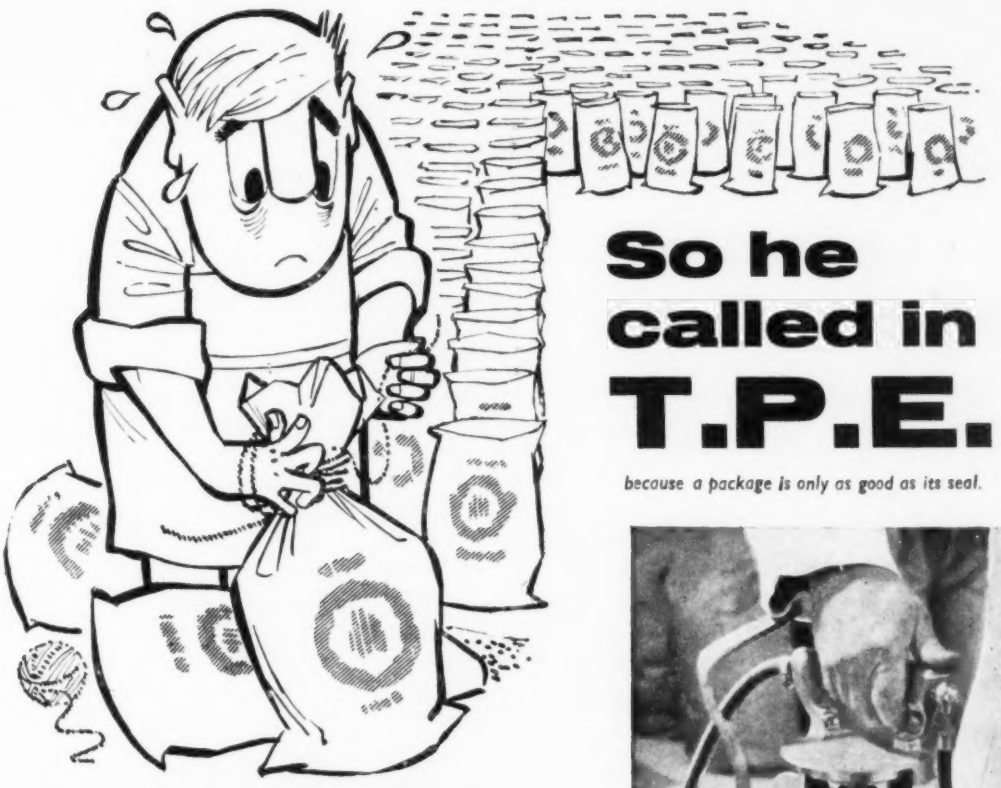
Lime salts in bone char. J. GUERIN. *Proc. 6th Tech. Session Bone Char*, 1961, 121–142.—The Freundlich equation has been applied to the relationship between the purifying properties of a bone char and the impurities (mainly Ca) present on its surface and which may be desorbed into a liquor undergoing treatment. The constants of the equation were determined for various chars and from these adsorption ratios were obtained. The Ca in char effluent was also determined. The condition of a char in use or fresh from the kiln may be judged from its DH (concentration of Ca salts in the water extract), which should be as low as possible and no higher than 4 or 5 (1 unit = 5·7 mg CaO/litre); its pH, the optimum of which is 9·3; the adsorption potential and the ratio 10 K/m (Freundlich constants); neutralization curves, which should exhibit buffer zones at pH 9·0–9·3 and no plateaux in the acid region; the carbonate and carbon content—the carbon and natural $CaCO_3$ contents should be as close to those of the new char as possible, while no CaO, adsorbed $CaCO_3$ nor sulphide should be present. Reasons are suggested for variations in the DH after kiln regeneration in comparison with the value before reactivation.

* * *

Hydraulic transportation of granular activated carbon. D. W. GILLMORE. *Proc. 6th Tech. Session Bone Char*, 1961, 167–181.—Details are given of pilot plant tests on conveying Pittsburgh CAL granular active carbon in a carbon/water slurry and on discharge of the carbon from filters. The slurries may be transported easily through 1–3 inch pipelines between filters and regeneration equipment. Recommended linear velocity is about 3·5 ft/sec, with a minimum value of 2·5 ft/sec. The slurry should contain 2-3 lb carbon per gallon of water. Over a wide range of flow rates pressure drops are normal and at the recommended water:carbon ratios approach those of water alone. There is no significant loss of carbon by attrition when centrifugal and diaphragm pumps are used. The slurry may be de-watered in drainage vessels to a carbon moisture content of 45% or by vibrating screens. Descriptions are also given of commercial hydraulic handling installations.

* * *

Continuous phosphate defecation and clarification in sugar refining. E. D. GILLETTE. *Proc. 6th Tech. Session Bone Char*, 1961, 225–247.—Details are presented with illustrations of the equipment and processes used at Refined Syrups & Sugars Inc. for continuous defecation and clarification of washed raw sugar with phosphoric acid and calcium saccharate. The clarifier muds are treated in a station of three continuous centrifuges manufactured by A/S. Titan of Denmark. The clarity of the effluent from these machines is improved by adding 1% by volume of a 0·8% solution of flocculating agent ("Separan") to the feed. Tests have also been conducted with a Westfalia SAMN 15007 centrifuge which operates in the same manner as the Titan and has approximately the same capacity (6 gal liquid). It is somewhat easier to maintain and has operated satisfactorily for nearly one year. The advantages of centrifugal mud treatment include: (a) it is a continuous process; (b) the volume of liquor in process is reduced; (c) better control of pH, defecation, and clarification; and (d) the centrifuge has low space requirements. Disadvantages include: high capital costs and need for a definite maintenance programme.



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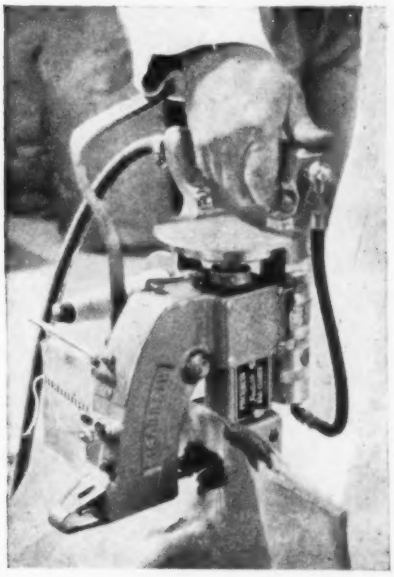

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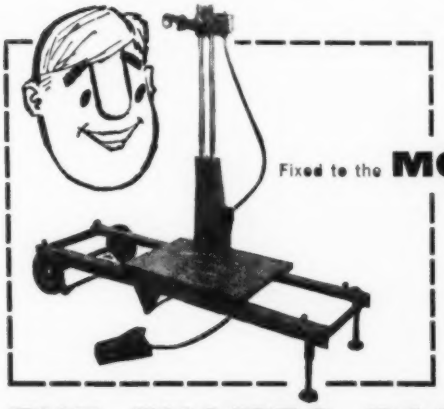

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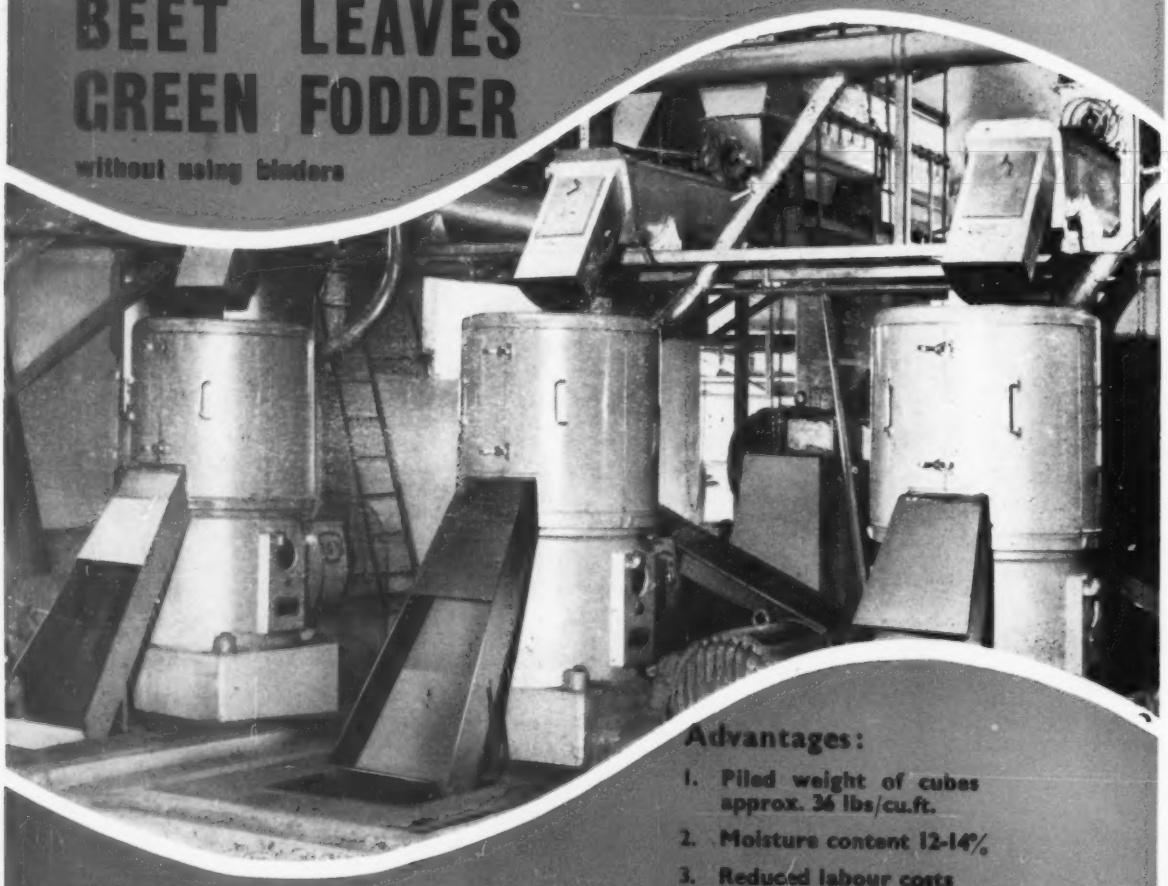

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BEET FACTORY NOTES

The Kollár predefecation unit. E. VALKOVSZKY. *Cukoripar*, 1961, **14**, 8–11.—Details and diagrams are presented of two cylindrical preliming units which are based on a common principle. One is horizontal and the other vertical. The horizontal type contains a framework divided into a number of compartments by partitions but having a free space overhead. In each partition is a hole in which is inserted an impeller of the type used in centrifugal pumps. The impellers suck in the juice and expel it radially on the other side of the partition. Raw juice is fed at one end, lime is added near the other end and muddy juice approximately halfway along the vessel. Sludge is discharged through ports in the bottom of the vessel. The impellers throw the limed juice back to the preceding compartment against the stream of freshly fed juice and help to mix the muddy juice in with the raw juice. The lime:juice ratio and thus the juice pH is controlled by longitudinal movement of the frame with the compartments and of the impellers which are mounted on a common shaft. In the vertical version the partitions are fixed and only the impellers move vertically, so that some of the juice is recirculated in the same compartments and some is returned to the previous compartment. Foaming is prevented by spraying hot muddy juice from the top of the vessel into each chamber. The juice retention time is 6, 12 or 20 min at 60–65°C, with 50–70% muddy juice return. The treated juice is heated to 80–85°C before passing to carbonatation. The 1st carbonatation juice has good settling and filtering properties, even when poor beet are processed.

* * *

Pectins and their rôle in sugar manufacture. II. A. VIGH. *Cukoripar*, 1961, **14**, 33–37.—The effect of pectins on beet storage, diffusion and crystallization are discussed with 40 references to the literature.

* * *

Some problems of instrumentation and automation in sugar production. M. TEGZE. *Cukoripar*, 1961, **14**, 37–40.—A survey is presented of general problems connected with automation, in particular of continuous diffusion and liming.

* * *

Swedish study tour. K. VUKOV and P. WERTÁN. *Cukoripar*, 1961, **14**, 25–28, 53–57, 85–92.—A review is presented of the Swedish sugar industry, including beet cultivation, processes and research, and of sugar machinery manufactured in Sweden.

* * *

Continuous boiling. L. BÁLINT. *Cukoripar*, 1961, **14**, 105–111.—The advantages of continuous boiling are discussed and details and illustrations presented of the pans designed by the Kiev Food Industry Research Institute, by SAITZEW[1], MORZE[2], and by PLATTE-DE VRIES[3]. The work of ZHVIRBLYANSKII is discussed in detail.

Bulgarian study tour. J. NAGY, J. KOLLÁR and B. VICZIÁN. *Cukoripar*, 1961, **14**, 66–77, 97–100, 118–120.—The equipment and processes used in the Lom, Ruse, and Gorna-Orechowitza beet sugar factories are described with numerous illustrations. Lom factory was erected in 1959, and the other two factories have been re-constructed during the last two years.

* * *

Continuous sugar centrifugalling. L. BÁLINT. *Cukoripar*, 1961, **14**, 143–148.—A survey is presented of continuous centrifugals, including single- and multi-stage push-type machines of the Escher-Wyss type, the Sokolov-Tombaev machine[4], the helical type built by Meiderich G.m.b.H. of Duisburg, and the "Hydromat" conical machine[5].

* * *

Industrial waste water economy in sugar factories of West Germany. K. SKALSKI. *Gaz. Cukr.*, 1961, **63**, 111–115.—An illustrated survey is presented of the equipment and processes adopted in Germany for treatment of sugar factory waste water.

* * *

Factory treatment of process liquors using activated carbon in a continuous process to improve sugar quality. T. W. BAKER, D. R. HASKELL and I. A. RESCH. *Sugar y Azúcar*, 1961, **56**, (5), 33–36; (6), 54–56.—Details are given of the Continuous Adsorption Process (CAP)[6] used at the Woodland beet factory of Spreckels Sugar Company for treatment of juices and syrups with Pittsburgh granular active carbon. The scheme includes 3 carbon columns, one sweetening-off column and a regeneration kiln. The sweet water effluent from the sweetening-off column, of 15–20 RDS, is returned to the factory for purification and evaporation. The sweetened-off carbon is withdrawn as in the CAP columns. Details are given of the controls, which, as well as the heater temperature and liquor density controls, are located at a central panel. The system for conveying of the spent and fresh carbon is described, as is the system for dewatering of the carbon slurry before kiln regeneration. Sugar losses in the CAP over a campaign amount to 0·02% on sugar entering the factory. Graphs are presented showing the effect of using the CAP in 1959 compared with the results obtained when conventional process methods were used. Despite a higher sugar content in cossettes in 1956 and almost equal juice purities in 1956 and 1959, white sugar yield was higher in 1959. Slicing capacity was increased by 236 tons per day (mainly attributed to use of the CAP), and the average sugar production was increased by 770 bags per day. To maintain the

[1] *I.S.J.*, 1948, **50**, 137–138.
[2] *Zucker*, 1959, **12**, 4–7; *I.S.J.*, 1959, **61**, 276.
[3] *Zeitsch. Zuckerind. Czechoslov.*, 1938, **63**, 213–216, 222-224.
[4] *Sakhar. Prom.*, 1949, (5), 22–25; *I.S.J.*, 1950, **52**, 336.
[5] *I.S.J.*, 1957, **59**, 186–187.
[6] *I.S.J.*, 1961, **63**, 28.

sugar quality in 1956, 4·84% of the sugar produced had to be recycled, while in 1959 the sugar quality was higher without recycling. The floc content of the liquor was very low, the colour and turbidity appreciably lower than those of untreated liquor, and foaming characteristics greatly improved. Gross savings per bag of sugar, including those resulting from cuts in man-hour requirements, amount to 73 cents.

* * *

The determination of lime consumption in raw juice purification. V. S. VASILEGA. *Sakhar Prom.*, 1961, (6), 16–18.—A formula is presented for calculation of % lime consumed (x) in raw juice purification: $x = \frac{A_f^{II} \cdot L_{unf} \cdot CaO_{free}}{(107 - 2\ L_{unf})\ CaO_{tot}}$, where A_f^{II} = amount of 2nd carbonatation juice %, and L_{unf} = total content of lime in unfiltered 1st carbonatation juice (g CaO/100 ml juice). The calculated lime consumption is 25% less than the figure given by a formula presented in instructions on beet factory chemical control.

* * *

Regeneration of ion exchange resins. P. V. GOLOVIN, M. A. ABRAMOVA, Z. B. SHAPOSHNIKOVA, A. A. GERASIMENKO, E. V. DENISOVA and G. S. TRET'YAKOVA. *Sakhar. Prom.*, 1961, (6), 13–16.—Tests on 2nd carbonatation juice treatment with KU-1 cation and EDE-10 anion exchange resins have shown that in the case of the cation exchanger, juice purity is raised by 0·54 units even after 48 cycles and despite a drop in resin capacity. Regeneration with HCl has been found to be incomplete because of the inhibiting effect of colloidal substances absorbed by the resin from the juice. When treating good quality juice this may be overcome by treating the resin after 10–15 cycles with 1 volume of 5% caustic soda solution per volume of swollen resin at 20°C before the acid regeneration. The anion exchange resin may be completely regenerated by treating with 3 volumes of 0·5% NaOH solution plus 12 volumes of water per volume of swollen resin.

* * *

Method of rational sweetening-off of muds on disc filters. V. A. ZAMBROVSKII. *Sakhar. Prom.*, 1961, (6), 18–23.—Experimental results agree closely with calculated results on sugar losses in disc-filter muds on weight % solid phase as dependent on the dry solids of the final portions of wash water and on the amount of mud in the filter. Losses may be reduced, e.g. from 1·22% to 1·10%, by re-using wash water to start sweetening-off of the succeeding filter. The ammoniacal water consumption is also reduced. The drop in dry solids of the wash water was studied with a view to establishing the point at which the liquid should be sent to the lime station for milk-of-lime production; for a 6·2-cu.m. filter this is 3·8%. A scheme is described for removal of sweetening-off water and muds.

Improving the control filtration of 1st carbonatation juice. A. E. DUDNIK. *Sakhar. Prom.*, 1961, (6), 24.—To overcome the difficulties caused by colloidal substances accumulating on the cloths in 1st carbonatation—whole juice filter presses when poor beet are processed, it is recommended that a layer of muds be built up by filtering cloudy 1st carbonatation juice, so forming a pre-coat. A flow scheme is presented. This has resulted in better filtration, the colloids being trapped between the calcium carbonate particles. However, the editor points out that this should be regarded as only a temporary measure and advocates kieselguhr instead of 1st carbonatation muddy juice.

* * *

Calculation of the amount of sugar recovered from molasses. I. M. PEKHTMAN. *Sakhar. Prom.*, 1961, (6), 44–46.—Experience at the Steffen plant of Mizochsk sugar factory has demonstrated the expediency of determining the sugar recovery by weighing the saccharate milk and determining the sugar content of the milk. Calculations of the various loss factors, etc. are presented as a guide.

* * *

Continuous sugar factory processes. J. NAGY. *Cukoripar*, 1959, **12**, 322–234; 1960, **13**, 21–25, 52–55, 78–79; 1961, **14**, 12–15, 44–48.—Diffusion and juice purification processes and equipment are reviewed. The theoretical bases of diffusion, the influence of non-sugars and temperature, causes of sugar losses, and other factors are discussed, and the Roberts battery diffuser compared with continuous diffusers, among which are described the Bergé, RT, Olier, BMA and "J" types. The theory of juice purification and the developments in pre-and main defecation are described, including the rôle and methods of continuous liming and carbonatation, the Brieghel-Müller and Kollár pre-liming equipment, the effect of muddy juice return and hot predefecation, the use of hydrocyclones for treatment of 2nd carbonatation juice, milk-of-lime and waste water, and equipment for continuous defecation and mud separation. Dorr, Olier and other types of settlers used in Hungary are described as well as vacuum filters, and details are given of the Wiklund process and the Schneider-BMA defeco-saturation process.

* * *

The Hungarian "J" diffuser. S. I. GERASIMOV and V. A. SELYATITSKII. *Sakhar. Prom.*, 1961, (6), 64–71.—Details are given of the "J" diffuser and ancilliary and control equipment and performance data for Sarkad and Selyp factories are presented. Average losses have been about 0·6% on weight of beet at around 128–129% juice draught. The advantages of the diffuser are enumerated and comparisons drawn between the "J" and a Roberts battery diffuser. Defects of the "J" include return of some pulp adhering to the chain links and frames, and the absence of automatic control of the water:cossette ratio.

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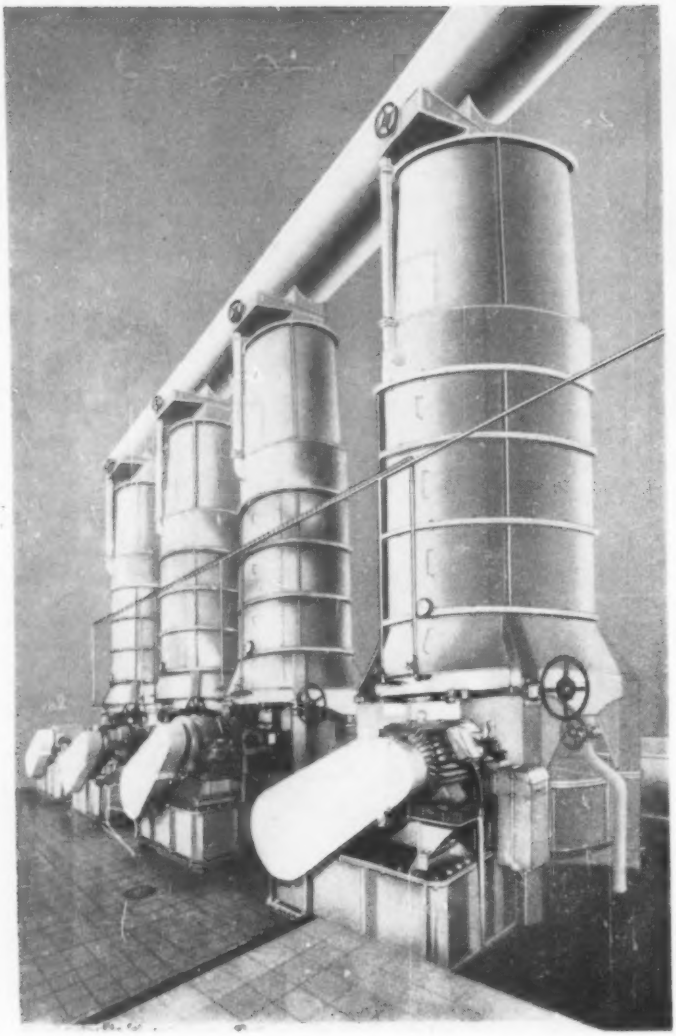

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Zuckerwirtschaftliches Taschenbuch 1960. (Economic Sugar Pocket Book 1960.) H. MOSOLFF and G. BRUHNS. 165 pp.; 4 × 5¾ in. (Verlag Dr. Albert Bartens, Lückhoffstr. 16, Berlin-Nikolasse, Germany.) 1961. Price : DM 8.00.

Newer information (1960) has been added to the 8th edition of this useful pocket reference book and there have been one or two minor changes within the three main sections. The data (tabulated and in graph form) cover various aspects of the world, European and German sugar industries, including beet areas, sugar and molasses production, imports and exports, consumption, sugar prices, the structure of the sugar industry in the EEC and in the member countries, particularly France and Germany, and details of international and local agreements. The third section contains addresses of German sugar organizations, etc., sugar factories and a list of U.S. sugar companies. The general layout of the book remains unchanged from the previous edition[1] and the book is recommended to those requiring economic data on the European sugar industry.

* * *

Azúcar Mexicano. (Mexican Sugar.) 9 pp.; 8¼ × 11 in. (Unión Nacional de Productores de Azúcar, S.A. de C.V., Mexico 1, D.F.) 1961.

This booklet, plentifully illustrated and printed in colour, provides information on the economic and social aspects of the Mexican sugar industry which has doubled production since 1956, so increasing the country's purchasing power by earning of foreiga, and especially U.S., currency. Breakdowns are given of the distribution of income received from sugar sales, and of cane areas of the kinds of growers. The cultivation of cane provides a livelihood for more than 150,000 workers, and the planter knows that all his cane must be bought by the factory. Information on research and investigational bodies serving the industry is provided, as is a table of production and consumption, including outturn estimates for 1961 to 1964, these being 1,400,000 tons to 2,006,000 tons, respectively. The types of sugar-producing companies are classified with their proportion of production in 1960/61, while information is given on the "fringe benefits" for sugar workers. A note is given emphasizing the small part of the world's sugar production involved in the free market—6·8 million tons out of 52·6 million tons.

Blyth, Greene, Jourdain & Company Limited 1810–1960. A. MUIR. 55 pp.; 7 × 9½ in. (Newman Neame Ltd., 50 Fitzroy St., London W.1.) 1961.

This is a well-printed brief history of Blyth, Greene, Jourdain & Co. Ltd., the old-established firm of merchants, which has expanded until now the group includes firms in London, Mauritius, Malaya, Sarawak, Hong Kong, South Africa and Rhodesia. The firm has had close connexions with Mauritius, and mention is made of the transporting of Mauritius sugar in the 1860's. The Peruvian Sugar Estates Co. Ltd. is also mentioned—Blythe, Greene, Jourdain & Co. Ltd. became commercial agents of this firm in 1895—as well as the disaster which befell the Mauritius sugar industry when the disease surra killed nearly all the animals of burden on the island and forced men to haul cartloads of cane to the factories. The British Government set up a Royal Commission to study the Mauritius sugar industry and in 1908 granted it a loan. The number of sugar mills had fallen from 300 in 1864 to 60. The Commission entrusted the Company with the chartering of vessels to carry the first 100,000 tons of sugar to the U.K. in 1914. The book is well illustrated with documents, portraits and pictures of the Company's early trading ships.

* * *

Sugar Year Book 1960. v + 268 pp.; 3¾ × 5½ in. (International Sugar Council, 28 Haymarket, London S.W.1.) 1961. Price: 20s 0d.

The 14th edition of this useful publication contains 59 more pages than the 1959 edition and has a slightly larger format. The main section of 198 pages comprises tables of centrifugal sugar production, imports and/or exports, consumption, and stocks for 89 countries covering, in most cases, the period 1954–1960. Tables for Netherlands Antilles have been omitted this time, while new countries include Cyprus and Kuwait. The other section of the book includes tables showing world sugar production, imports, exports, stocks, consumption, consumption per caput, and prices. The period covered is 1954–1960, except for per caput consumption (1954–1961) and world prices (1959–1960). Details are also given of the International Sugar Agreement export quotas 1959–1960, U.S. Sugar Quotas 1959–1961, and Retail Sugar Prices 1960–1961. The final table gives equivalent weights and measures.

[1] *I.S.J.*, 1961, **62**, 24.

Polarographic determination of α-amino acids. I. PAULIK. *Cukoripar*, 1961, **14**, 49–52.—The α-amino acids in sugar juices and molasses are determined by adding a buffered alkaline suspension of copper phosphate to lead-clarified juice or molasses solutions and determining by polarographic means the copper in the complexes formed with the amino acids. The method is rapid, highly accurate and requires very small amounts of chemicals. Further tests are to be carried out to determine the possible error due to the presence of hydroxyacids (citric and tartaric acids) in the juice.

* * *

Sucrose solubility. III. Limitations of solubility tables. G. VAVRINECZ. *Cukoripar*, 1961, **14**, 61–65 and inside back cover.—The solubility values obtained by several authors are compared and some of the results are recalculated at given temperatures. The results are weighted from 1 to 4 for the sake of accuracy and the deviation and scatter tabulated for each author with the temperature range originally covered. A 4th power equation has been found suitable for interpolation.

* * *

pH determination of beet raw sugar. A. EMMERICH and C. REICHEL. *Zucker*, 1961, **14**, 340–343.—Results are reported of tests in which the pH of beet raw sugar was determined and the values compared with phenolphthalein alkalinities. The latter were erroneous in many cases, particularly with highly coloured samples, the phenolphthalein buffer solution raising the pH of the sugar solution. The pH values of buffer solutions and of sugar solutions prepared with CO_2-free water were measured by 23 associated laboratories and showed excellent agreement with the Institute Laboratory's values. In further tests on raw sugar solutions, pH measurements corresponded with phenolphthalein alkalinity, although in two cases alkalinity was equivalent to a pH of 8·1, while the pH was low at 7·25 and 7·30 respectively. The sugars were very pure and had a low non-sugar content, so that they were very weakly buffered and the solution water must have had a buffering effect of almost 1 unit. For pH measurements the solution water should have a maximum conductivity ash content of 0·01%, and the measuring temperature should be 15–20°C. The maximum tolerance should be ±0·05 units. Capillary flow cells are recommended, especially with weakly buffered solutions. Standard buffer solutions used are: phosphate solution, of pH 6·88, containing 3·4023 g potassium phosphate and 4·4503 g sodium phosphate in distilled water made up to 1 litre, and a borax solution of pH 9·22 containing 3·8144 g borax in water made up to 1 litre.

True purity (calculated) and true purity (lowest possible). J. R. ARIOSA M. *Bol. Ofic. A.T.A.C.*, 1961, **20**, 41–43.—Two formulae for molasses true purity are examined: that of WEBRE (lowest possible), i.e. 0·7857 × apparent purity + 21·43, and that of SIJLMAN: Clerget sucrose/Brix — (ash × 0·72). The former is subject to change as a result of variations in ash and glucose, while the latter can readily be checked by comparison of the denominator with solids by dessication, and is thus to be preferred. The minimum possible purity, calculated according to the Douwes Dekker formula [35·886 — 0·08088 × glucose % non-sucrose + 0·260477 × ash % non-sucrose], is more realistic under Cuban conditions than the Webre formula purity.

* * *

Fibre determination methods. C. W. WADDELL. *Producers' Review*, 1961, **51**, (5), 31–33.—Certain factors are influencing the desire for development of a satisfactory sampling and analytical method for determination of cane fibre. The existing methods are outlined with their advantages and disadvantages. Research is being conducted on such methods as: expressing juice from a pre-weighed sample by applying a constant pressure for a given time, then measuring the volume or weight of the fibre "plug" or pressing to a fixed volume and weighing the "plug"; sampling methods involving the use of existing mill knives and shredders; and other modifications for cane sampling.

* * *

Distribution of sugar in a cossette during diffusion. P. DEVILLERS. *Sucr. Franç.*, 1961, **102**, 157–161.—Laboratory tests were carried out in which synthetic cossettes made by rolling up a circle of chromatography paper were homogeneously impregnated during 24 hr with a 19% sugar solution and then immersed in water at a constant temperature. At the end of a given time, the "cossette" was withdrawn and cut into spirals. The concentration of sugar in each spiral was determined and a curve of sugar distribution drawn. Details are given of the sugar concentration at different points of the "cossette". The results indicate two phases in diffusion according as the concentration of sugar has or has not commenced to diminish in the centre of the "cossette"; the first phase is rather short in comparison with the total diffusion period. The average concentration of the "cossette" at the end of time t is given by $C = a.e^{-Kt}$, since diffusion seems to follow the generally accepted laws. For a given stage of diffusion, time is proportional to "cossette" cross-section and inversely proportional to the length of cossette per 100 g.

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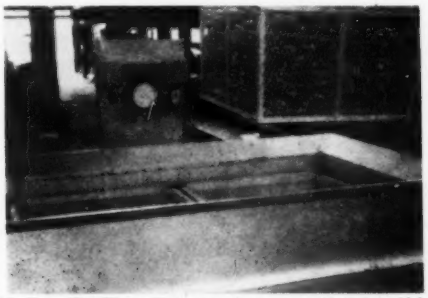

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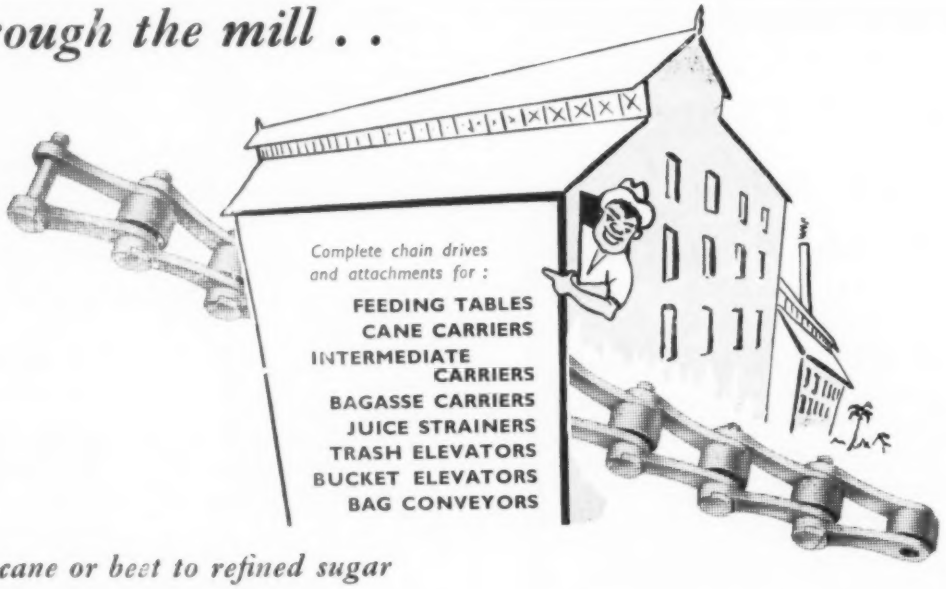

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Simplified method for the determination of total reducing sugars in cane molasses. M. FALCONE, M. L. R. VAIRO and W. BORZANI. *Anais Farm. Quim. Sao Paulo*, 1959, **10**, 69–72; through *S.I.A.*, 1961, **23**, Abs. 308.—The following method, which obviates lead acetate clarification, was found to give more precise results and was more efficient for regular use than the usual method with lead clarification. Put 10 ml of diluted molasses (60 g in 200 ml of distilled water) in a 500 ml graduated flask, add 100 ml of water and 5 ml of conc. HCl, heat to 60–65°C for 10 min, cool, neutralize with 4N NaOH (to phenolphthalein), make up to 500 ml and titrate 10 ml with Fehling's solution. Results by the old and new methods are compared for ten samples of molasses; three analyses were made by each method for each sample and the variances of the means are calculated and compared.

* * *

Equilibria of sucrose with mineral salts and oxides of bivalent metals in sugar solutions. Z. BAKASOVA. *Trudy Molodykh Nauch. Rabotnik. Akad. Nauk Kirgiz. SSR*, 1958, 139–161.—A survey is presented of the literature, with 36 references, on the properties of sucrose, particularly its solubility, and the behaviour of various mineral components added to sucrose solutions, including calcium, strontium and barium oxides, and sodium and potassium chlorides, sulphates, carbonates and nitrates. The properties of laboratory-prepared sucrose-calcium chloride and sucrose-magnesium chloride solutions were studied at 25°C and 40°C and the s.g., viscosity and refractive index of the solutions determined. In the case of the sucrose–$CaCl_2$ solution each of these factors may be represented by a curve having three distinct phases. The first corresponds to the crystallization of calcium chloride hexahydrate, the second to the formation of a binary compound, and the third to the formation of a solid sucrose phase. The binary compound was analysed and found to correspond to the fomula $C_{12}H_{22}O_{11}.CaCl_2.2H_2O$. In the case of the sucrose-magnesium chloride solution, however, the three properties may be characterized by curves having only two distinct parts, corresponding to sucrose crystallization and crystallization of magnesium chloride hexahydrate.

* * *

Sugar crystallization. P. V. GOLOVIN. *Ukrain. Khim. Zhurn.*, 1961, **27**, (2), 263–268.—The values for the coefficient of supersaturation of impure sugar solutions calculated by means of various formulae vary considerably at the same Brix and temperature. It is recommended that the supersaturation coefficient (K_1) be calculated as $K_1 = s/a$, where s = amount of sucrose in one volume of water of a given solution, and a = amount of sucrose in one volume of water at saturation. The formula may be written as $K = \frac{S}{(100-B)a}$, where S = sugar content (%) and B = true dry solids in an impure sugar solution. The binding energy in homopolar crystals is determined as the potential energy of reaction between the two closest individual particles. Thus, as the distance between increases, the forces of reaction between the particles fall very quickly. The supersaturation coefficient is a measure of the increase in the number of sucrose molecules per volume of water which is accompanied by a reduction in the inter-molecular distance. This distance increases with drop in temperature as a result of increased hydration of the sucrose molecule. For a saturated pure sugar solution the distance in Angstroms is given by $A = \sqrt{\frac{108530}{ds}}$, where d = density. Some calculated data are tabulated for both pure and impure solutions. The relationship between the supersaturation coefficient and the distance between particles is given by $A = \sqrt[3]{\frac{108530}{K(100-B)ad}}$. Although the coefficient of supersaturation may be high, this is not necessarily proof that sucrose may be crystallized, since the intermolecular distance may be greater for an impure solution than for a pure solution at the same temperature. The crystallizability may be improved by adding a certain amount of crystal sucrose, bringing the molecules sufficiently close to overcome the resistance of the medium and ensure formation of a crystal lattice. Thus, calculation of the factor A will give an indication of the crystallization possibilities.

* * *

The characteristics of the sugar beet and molasses at Novo-Troitsk sugar factory. Z. P. KOVALENOK. *Trudy Molodykh Nauch. Rabotnik. Akad. Nauk Kirgiz. SSR*, 1958, 163–166.—Beet samples removed from the beet knives at Novo-Troitsk were analysed and the details tabulated together with those of juice and molasses analyses. The beet pol was rather high at 17·13–19·31% in 1953–56. The sugar content of purified juice was 17·80–19·27%, the juice purity 88·30 and 87·80 in 1953 and 1954 and 85·90 in 1955 (attributed to high invert content in the beet). The calcium oxide and silica content of the ash were high. The carbonate ash content of the final molasses was high at 9·33–10·38%, and the chlorine and SO_3 contents high. Despite the use of additional limestone, the magnesium oxide content was small, as with molasses from European Russia.

* * *

Determination of reducing sugars with 3,6-dinitrophthalic acid. T. MOMOSE, Y. MUKAI and M. WATANABE. *Talanta*, 1960, **5**, (3–4), 275–277; through *Anal. Abstr.*, 1961, **8**, Abs. 2469.—Reducing sugars (10 to 100 μg per ml) are determined spectrophotometrically by the method previously described[1]. The calibration curves for xylose and arabinose, for glucose, fructose and galactose, and for lactose and maltose coincide with each other, indicating that the configuration of the hydroxyl groups in the sugars does not affect the reduction. Mixtures of glucose and sucrose can be analysed with an error of ≃3% by determining glucose on one aliquot and total invert sugar on a second aliquot after inversion with 0·1N HCl.

[1] MOMOSE *et al.*: *Anal. Abstr.*, 1960, 7, Abs. 4919.

Separation of sugars on ion-exchange resins. I. Separation of oligosaccharides. J. K. N. JONES, R. A. WALL and A. O. PITTET. *Canad. J. Chem.*, 1960, **38**, (12), 2285–2289; through *Anal. Abstr.*, 1961, **8**, Abs. 2471.—Synthetic mixtures of oligosaccharides, and various polysaccharide hydrolysates, were separated on columns of the neutral salt forms of cation-exchange resins. The separation depends on molecular size; the equilibria between polyhydric compounds and ion-exchange resins have been studied by WHEATON and BAUMAN[1] and SAMUELSON *et al.*[2] The most satisfactory resin was "Dowex 50W-X2" (200 to 400 mesh, Li^+ form), and the separation of 100-mg amounts was complete in 24–48 hr with water as the developing solvent. Details are given of the separation of synthetic mixtures of raffinose and melibiose, of D-glucose and maltose, and of lactose and D-galactose. Recoveries were 97–105%. *O*-Alkylated monosaccharides were separated by the same method.

* * *

The automatic chloride titrator in the analysis of some ionic constituents. M. D. PEIPERL, F. G. CARPENTER and V. R. DEITZ. *Proc. 6th Tech. Session Bone Char*, 1961, 53–66.—Details are given of the titrator which includes two pairs of electrodes (one pair of indicating and one pair of silver-generating electrodes) and a small stirrer located between them. A constant D.C. (1·5, 6 or 24 milliamps) passes between the silver-generating electrodes. The chloride ions present in the test sample form insoluble silver chloride, and after all have been precipitated free silver ions accumulate in the titration medium. As soon as the free silver ions accumulate, they conduct current in the indicator circuit. The current increases until the indicator needle makes contact with an adjustable contact. This then actuates a relay which causes generation of silver ions to stop and stops the timer and stirrer. As the rate of silver ion generation is constant, the total amount of silver salt precipitated is proportional to the titration time. A constant is determined for each rate of titration, expressed in microequivalents of silver per second of titration. The samples (up to 6 ml) are acidified with 0·1N nitric acid in acetic acid (10% by volume). Some drops of a gelatin reagent are added containing an acid-base indicator. The average titration time is 1 min and average accuracy is 2%. Total anions may be determined to within 2% by converting to chloride using an anion exchange resin in chloride form. A linear relationship was established between total anions obtained in this way and conductimetric ash and the total anion content of a solution is also found to be dependent on pH.

* * *

A study of adsorption and desorption of colour, reducing sugars, and ash constituents in bone char filtration. W. MARCY, L. M. WASHINGTON and J. ABRAMOW. *Proc. 6th Tech. Session Bone Char*, 1961, 143–166.—Details are presented of factory-scale experiments carried out to determine the adsorption and desorption characteristics of bone char under normal operating conditions. For each of the liquors treated a definite downward trend in the percentage colour removal was observed during the cycle. About 25% of the total reducing sugars fed to the char was adsorbed, of which 90–93% was desorbed during sweetening-off. Of the total sulphated ash fed to the char, 60% was adsorbed, of which 43% was desorbed during sweetening-off. For Ca the respective percentages were 75 and 39, for potassium they were 45 and 59, and for magnesium they were 55 and 70. No sodium was adsorbed by the char. From this it is evident that a large portion of the adsorbed impurities was eventually recycled after desorption during sweetening-off. Graphs and tabulated data are presented.

* * *

Behaviour of bone char and hydroxyapatite in $CaSO_4$ and $NaHCO_3$ solutions. S. R. OLSEN. *Proc. 6th Tech. Session Bone Char*, 1961, 273–286.—Experiments were carried out to study the reactions involved in the adsorption and desorption of calcium sulphate from bone char and hydroxyapatite. A possible new reaction mechanism is proposed to explain the adsorption of $CaSO_4$ on bone char based on the presence of associated ion pairs or undissociated molecules in $CaSO_4$ solutions. The reactions of sodium bicarbonate and carbonate ions in the desorption or washing process are examined and probable mechanisms proposed. The desorption mechanism for SO_4^{--} is based on a two-fold action of CO_3^{--}, i.e. dissociation of the adsorbed $CaSO_4$ into Ca^{++} and SO_4^{--} ions and depressing of the Ca^{++} by CO_3^{--} through formation of some form of $CaCO_3$, and displacement of SO_4^{--} by CO_3^{--} from the char surface by ion exchange. This mechanism is confirmed by measurements of the changes in HCO_3^-, Ca^{++} and SO_4^{--} that occurred with bone char and $NaHCO_3$ solutions. The amount of SO_4^{--} adsorbed or desorbed from the char was a linear function of pCO_3. Desorption of SO_4^{--} from the char should take place faster and to a greater extent by leaching with dilute solutions of $NaHCO_3$ at atmospheric CO_2 pressure.

* * *

International (temperature) correction table for refractometers. G. VAVRINECZ. *Cukoripar*, 1961, **14**, 158–160.—When the test solution is made up in a measuring flask for refractometric Brix measurement, the temperature at which it is prepared and the temperature at which the Brix is measured differ, so that the international table for compensations is not valid, the correction to be applied being lower than the value in the table. These corrections are calculated and tabulated.

[1] *Ann. N.Y. Acad. Sci.*, 1953, 57, 159.
[2] *Acta Chem. Scand.*, 1958, 12, 1386, 1404.

BY-PRODUCTS

Filter-press muds from Kirgiz sugar factories. A. E. KHARAKOZ and A. F. GOLUBEVA. *Izvest. Akad. Nauk Kirgiz. SSR, Seriya Estestv. i Tekhnich. Nauk*, 1960, **2**, (3), 75–78.—Details are given of analyses of the waste water from Belovod factory and of the filter-press muds from 4 factories of the Kirgiz. These reveal the presence of trace elements Mn, Cu, Mo, B, etc. besides N and P_2O_5 in the muds, which are therefore recommended for use as fertilizer and as a source of phosphates for fodder purposes. The waste water is also recommended as a fertilizer.

* * *

The effect of ammonium sulphate and superphosphate on sugar destruction. A. M. MALKOV and L. I. BORISEVICH. *Trudy Voronezh. Tekhnol. Inst.*, 1960, **16**, 147–150.—Addition of ammonium sulphate to boiling molasses wort in yeast plants has been found in laboratory tests to increase thermal destruction of sucrose and the formation of dark coloured substances. Technical ammonium sulphate has a greater effect than chemically pure sulphate, and the effect increases with the amount added. Superphosphate inhibits thermal destruction of sucrose, the effect increasing with the quantity added. It is recommended that the superphosphate be added before boiling of the mash, and the sulphate after cooling.

* * *

Protein from sugar on Taiwan. W. C. HSU. *Sugar y Azúcar*, 1961, **56**, (7), 33–36.—The composition and uses of brewers and torula yeasts are discussed and some information given on the yeast plant at Hsing-ying, Taiwan, which produces 40 tons of yeast daily. Details are given of the processes at this plant, where the clarified blackstrap molasses solution is fed together with urea, superphosphate, ammonium sulphate and water continuously into 6 propagators, from which the yeast wort is withdrawn continuously. The wort is concentrated in centrifugal separators, and the yeast washed, reconcentrated, dried and blended.

* * *

Sugar cane wax. III. Composition of solvent-refined wax from sugar cane mud. J. A. LAMBERTON and A. H. REDCLIFFE. *Australian J. Appl. Sci.*, 1960, **11**, 473–480; through *S.I.A.*, 1961, **23**, Abs. 141.—Crude wax was extracted from fresh clarification muds and refined wax was separated (43% yield) by solvent fractionation from the fatty fraction (36%) and the dark "pitch" (21%). The refined wax differs from the cuticle wax in many respects, owing to the instability of the latter; analytical values, ultra-violet (λ_{max} 223 mμ) and infra-red (3400 and 1735 cm^{-1}) absorption bands, etc., are given; carbohydrate and phosphate were shown to be present. A fraction responsible for the very high saponification value (102) of the wax may contain calcium phosphatides. The properties after heating with dilute HCl were examined. After chromatographing the wax on alumina, various fractions were obtained by elution with different solvents. The presence of esters, conjugated carbonyl compounds, some alcohols, sterols, glycerol, and oxidation products (e.g. esters) and aldol condensation products of the aldehydes initially present in the cuticle wax, was shown. The "pitch" fraction from the crude wax was also examined. It had a high saponification value (175) and high ash (10·9%), phosphorus (1·9%) and nitrogen (0·4%) contents. From its properties on heating with acid it is probable that "pitch" components are also present in the hard wax. There was no evidence of the presence of polyfunctional molecules, such as di-esters and hydroxy-acids, in the wax, which is thus very different from carnauba wax or I.G. waxes. Sugar cane wax is therefore unlikely to become a substitute for these other waxes in commercial polishes, unless it can be improved by chemical modification.

* * *

Chick growth response to *Candida utilis* and protein phase of *Rhodotorula glutinis*. P. SOONG, T. C. HSU, S. C. LIU, and F. K. KOH. *Taiwan Sugar Expt. Sta. Rpt.*, 1961, (23), 91–99.—In tests in which 30% food yeast and fat yeast grown on molasses were fed to chicks as the principal source of protein during 8 weeks, the protein phase of *R. glutinis* (fat yeast) was found to increase the weight of the chicks, improve the efficiency of the feed and reduce the death rate of the chicks more than the food yeast. At 35%, both decreased growth rates and increased death rates.

* * *

Asphalt-impregnated bagasse board. I. C. I. NEE, C. T. YANG, and K. SHEN-TU. *Taiwan Sugar Expt. Sta. Rpt.*, 1961, (23), 125–145.—Asphalt-impregnated bagasse board has proved to be highly waterproof, weather-resistant and to have good insulating properties. Biological tests have also proved its resistance to termites. Bagasse board from non-cooked bagasse pulp is better for impregnation than water-cooked bagasse pulp, while lime-cooked bagasse is not suitable. The board, of density 0·5 ± 0·05 g/cc, is vacuum dried, completely impregnated with roofing or waterproofing asphalt under 5·5 atm pressure at a temperature 10° below the asphalt flash-point (205°C) and then subjected to vacuum again for heat recovery.

* * *

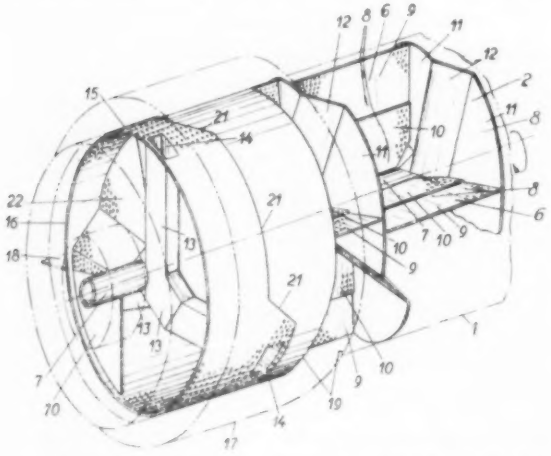
First results of sugar cane cattle fattening trials, Illovo. ANON. *S. African Sugar J.*, 1961, **45**, 307.—Fresh cane cut by forage harvester 3–4 times a day may be used as cattle fodder, although it is pointed out that attention should be paid to the age and type of beast selected and that the actual fattening period appears to vary. It was found in preliminary trials that the cattle consume approximately 70 lb of cane and tops per day plus 7 lb of molasses and 10–12 lb "Epol" cubes depending on weight of beast. A table is given demonstrating the increasing weight during the trials.

UNITED KINGDOM

Storage of sugar beet roots. R. SHIELDS, *comm.* ELFA-APPARATE-VERTRIEBS G.m.b.H., of Muelheim/Ruhr, Germany. **879,190.** 22nd August 1959; 4th October 1961.—In this method the wet stored (washed and disinfected) beet roots are piled up and mechanically ventilated by untreated air taken directly from the surrounding atmosphere and forced through the pile. The roots may be washed before transportation to the main storage point and are ventilated during the passage. The beet roots are moistened with fresh liquid after complete or nearly complete evaporation of the adhering liquid by the ventilation. The pile may be provided with roofs before ventilation.

* * *

Beet diffuser. RAFFINERIE TIRLEMONTOISE, of Tirlemont, Belgium. **879,655.** 20th January 1958; 11th October 1961.—The diffuser is in the form of a drum 1 along which beet cossettes pass in countercurrent to the extraction water. The transporting mechanism is in the form of an approximate helicoid 2 formed by plates 11, perpendicular to the axis of



rotation, joined by inclined plates 12. The helicoid 2 is divided into a series of cells formed by screens 6 spaced at slightly more than 90° (so that the first and last screens lie in the same axial plane of the drum). Beet cossettes are fed into a housing 17 at the end of the drum, passing through openings 14 and ducts 13 to the hollow end of shaft 7. The beets pass into the first cell which is formed by screen 18, the end-wall 16, the helicoid 2, and the drum surface 1. The screens 6 are constructed in two parts 9 and 10, the former fixed in relation to the drum and the latter hinged on part 9. A cam and hydraulic jack system controls the position of part 10 relative to part 9 so that as the drum reaches a particular point in each revolution, the part 10 forms an opening through which the cossettes fall into the next cell. Thus the cossettes travel along the helix at the rate of one cell per revolution or approximately ¼ pitch of the helicoid 2. Liquid introduced at the cossette discharge end is carried along the lower part of the drum by the helicoid and overflows through the opening 70 in the axial area of end-wall 16.

* * *

UNITED STATES

Dehydrating flowable matter (molasses). B. KVIESITIS and W. E. ROGERSON, *assrs.* VY LACTOS LABORATORIES INC., of Des Moines, Iowa, U.S.A. **2,991,179.** 31st October 1957; 4th July 1961.—The molasses is diluted (to 42°Bx), heated (to 95°F) and a clarifying agent (1% of $Ca(OH)_2$) added with agitation. Colloidal impurities are allowed to settle and the supernatant collected, heated (by live steam injection) to about 180°F (about 185°F) and sprayed into the centre top area of a tank into which heated air is also introduced above the molasses entry point. Cool or heated air is also introduced peripherally adjacent the tank walls, both air streams being downwardly directed. The second stream forms an air curtain adjacent the walls. The dried molasses particles are withdrawn from the tank bottom, separated from the air and mixed with about 1% by weight of tricalcium phosphate.

* * *

Beet harvester (finger wheel assembly). E. J. HAMMER, of Miller City, Ohio, U.S.A., and O. H. HAMMER, of Fostoria, Ohio, U.S.A. **2,993,545.** 21st July 1959; 25th July 1961.

* * *

Citric acid fermentation. S. KONISHITA, O. TERADA and K. OISHI, of Tokyo, Japan, *assrs.* KYOWA HAKKO KOGYO K.K., of Tokyo, Japan. **2,993,838.** 4th February 1958; 25th July 1961.—A citric acid-producing strain of *Trichoderma viride* (*T. lignorm*, *T. coningi*, *T. album* or *Verticillium glaucum*) is cultured (by a rotary or stationary culturing method) in a medium (liquid or solid) containing carbohydrate material (glucose, fructose, sucrose, maltose, waste molasses, dextrin or starch), nitrogen source and inorganic material source at pH 3–7, producing citric acid and its salt which is recovered.

Copies of Specifications of United Kingdom Patents can be obtained on application to H.M. Patent Office, 25 Southampton Buildings, London, W.C.2. (price 4s. 6d. each). United States patent specifications are obtainable from: The Commissioner of Patents, Washington, D.C. (price 25 cents each).

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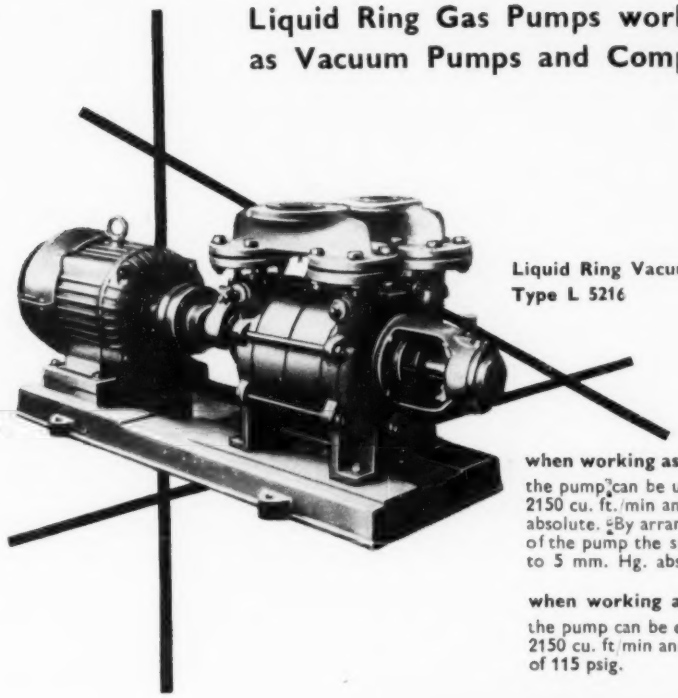

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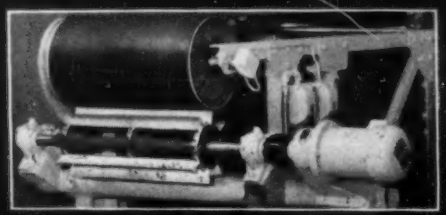

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TRADE NOTICES

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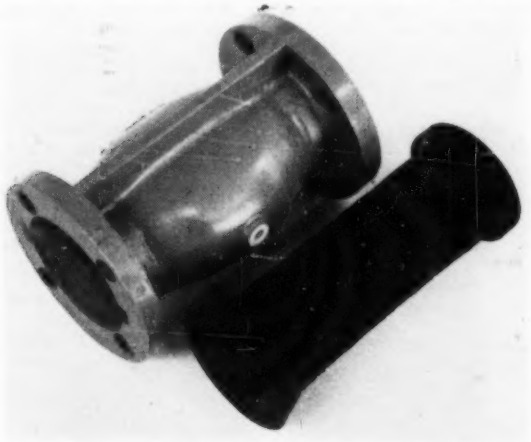
The Clarkson valve type "J". Neldco Processes Ltd., Crossway House, Bracknell, Berks.

The Clarkson valve is ideally suited for remote control and operation from instruments. Standard and inexpensive control equipment is adequate and the installed cost of an automatically controlled Clarkson valve is substantially lower than that of any other



type of valve. It consists simply of an alloy casting into which is fitted a specially designed rubber sleeve. The valve is operated by low pressure air, 30 p.s.i. being required to close it completely, and the aperture is similar to that of a normal pinch valve. At present it is available in sizes from 2 in to 10 in with flanges to B.S. Table D.

* * *

"Adcora Pervon." E. & F. Richardson Ltd., Buckingham, Bucks.

This new anti-corrosive coating is a polyurethane pitch material and cures rapidly at all temperatures even below freezing point. It is unaffected by high humidity during curing, and can be applied both to blast cleaned metal and to less thoroughly prepared surfaces. Iron surfaces protected with "Adcora Pervon" emerge unscathed after 6 months' immersion in 20% nitric or chromic acid. The coating is equally unaffected by aliphatic or aromatic solvents, fatty acids and alkalis, even at temperatures of up to 80°C.

* * *

The "Dalamatic" automatic dust collector. Dallow Lambert Ltd., Thurmaston, Leicester.

The "Dalamatic" filter is a genuinely continuously rated filter, capable of giving trouble-free service over an extended period. It employs a little compressed air for cleaning, but has no mechanical moving parts. Air volumes up to 100,000 c.f.m. can be handled. Where there is a heavy dust burden, a preliminary screen is fitted to pass only the fines to the filter. Dust retained is removed by controlled blasts of compressed air to the hopper and is eventually discharged by means of a rotary seal. The units are compact and reliable, well instrumented and of virtually 100% efficiency.

* * *

Automatic bunker clearance installations. Sinex Engineering Co. Ltd., North Feltham Trading Estate, Feltham, Middx.

Hopper blockages by funnelling, arching or build-up of material on the sloping sides may be due to the shape of the hopper, size of the outlet, or characteristics of the material, i.e. granulometry, moisture content, etc. In most cases the last of these is the cause and proper discharge can be ensured by application of suitably designed vibration equipment with automatic controls for timing and interlocking with the outlet gates. Working out the most suitable equipment is a feature of the Sinex Engineering service, as is the supply of the apparatus recommended.

* * *

The Forplex Mill. Russell Constructions Ltd., Russell House, Adam St., London W.C.2.

An important feature of the design of this new mill is the interchangeability of the grinding elements which allows the operator to grind a wide range of products at various outputs with one model. The change over from one type to another can be carried out rapidly, access being through a hinged door on the face of the mill chamber.

The grinding process is performed by a rotating disc or rotor fitted with concentric hammers running between the teeth of a disc located on the door of the mill chamber. The particles of material being ground, including sugar, are subjected to continuous and high frequency attrition between the high speed rotary and the static grinding element and are thrown by centrifugal force against a circular drum in the form of a screen or slotted plate which surrounds the periphery of both grinding elements.

The rotary assembly creates a draught which expels the fine particles through the screen to a hopper while the coarse or partially ground material is forced back towards the axis of the mill for further breakdown. If it is required to reduce the material to below the sieve range, multiple pin high speed and static elements are used and the particle size can be controlled by varying the speed of rotation. This arrangement is also effective for substances which tend to clog the surrounding screen or slotted plate.

The Forplex mill is produced in various sizes for outputs from 14 lb to 5 tons per hour. It is compact in size, the smallest unit having a floor area of 18 × 9 in and a height of 24 in and the largest being 18 × 48 × 66 in high.

Molasses Meal Mixer. Schuurmans & van Ginneken N.V., Amsterdam, Holland; Christy & Norris Ltd., Chelmsford, Essex.

The fully automated Schugi mixer processes *cold* molasses in order to ensure that each particle is completely coated by a film of meal fines. The use of heated molasses has the effect of breaking this film as also do mixers operating on the conventional "rubbing-in" principle. The Schugi mixer operates on a vertical principle, the meal travelling down the cylinder while high-speed revolving knives bring about a microscopic dispersion of the molasses. The result is a meal free from dust, free-flowing and dry to the touch which contains no lumps however small and which is virtually unchanged in colour. It can be bagged and stacked without fear of caking and is eminently suitable for cubing and pelleting.

The standard Schugi unit comprises mixer and molasses pump both fitted with motors, servo-operated valve and electro-magnetic 3-way valve, molasses regulating equipment, meal level switch, control panel, two molasses strainers with four valves and minor accessories. The regulating device ensures a uniform flow of molasses to the mixer, pre-set from the control panel and self-adjusting to changes of viscosity. The pump is capable of pumping unheated molasses of any viscosity and is of sufficient capacity to dispense with an intermediate service tank. Cold molasses can be pumped direct from the main storage tank to the mixer regardless of distance and elevation of the discharge piping. The molasses strainers permit alternative cleaning without stopping the operation.

The entire unit is operated by remote control from the control panel and has an output of 5–15 tons of molassed meal per hour, with a guaranteed output of 10 tons using a mix of 10% molasses to finely ground meal of density of at least 31–37 lb per cu.ft.

* * *

PUBLICATIONS RECEIVED

CROFTS MAKE CLUTCHES FOR EVERY PURPOSE. Crofts (Engineers) Ltd., Thornbury, Bradford 3, Yorks.

A new booklet of the above title describes and illustrates the Crofts range of clutches and brakes, including their patent "Airflex" magnetic instrument, "Ortojust" stationary field magnetic, "Bom-L" multi-disc, centrifugal multi-disc, rim, and "RM" roller-operated equipment.

* * *

ULTRA-VIOLET DETECTOR HEADS TYPES UV1/UV2. Elcontrol Ltd., Wilbury Way, Hitchin, Herts.

A new data sheet, Advance UV1/UV2, describes the new U-V detection heads which, used in conjunction with flame relay or fully automatic equipment, can be used for flame detection or detection and remedy. They can also be used in conjunction with a U-V source for invisible ray alarms, switches, etc.

* * *

"TOSHIBA" SUGAR REFRACTOMETERS. Tokyo Shibaura Electric Co. Ltd., 1 Uchisaiwaicho 1-chome, Chiyoda-ku, Tokyo, Japan.

The "Toshiba" hand sugar refractometer is available in three types for sugar solutions of 0–32%, 28–66% and 50–85% concentration, having accuracies of 0·2, 0·3 and 0·5% respectively. All are small and light, of sturdy construction, and are simple to use.

BY-PASS ROTAMETERS. Brooks Instrument Company Inc., Hatfield, Pa., U.S.A.

Bulletin 116 describes and provides capacity, flow-range and other data on by-pass rotameters for use in measurement and control of flow rates in pipes as big as 48 inches.

* * *

ROCOL RTD SPRAY. Rocol Ltd., Rocol House, Swillington, Leeds.

Publication 21 gives details of this new spray which is an aerosol form of Rocol RTD lubricant for machining, drilling, tapping, reaming, etc. The spray is economical and eliminates the messiness of a brush-and-pot lubrication system. It permits the lubricant to reach places which were formerly inaccessible.

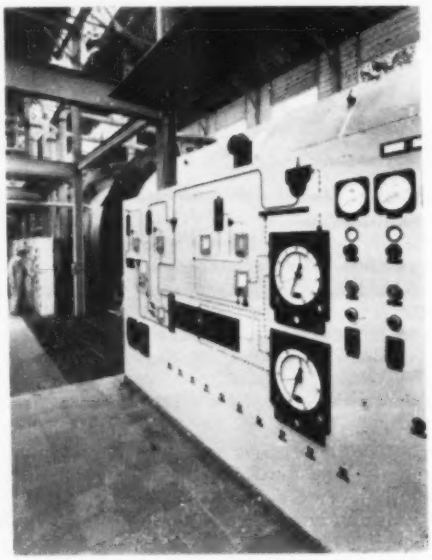
* * *

COMMANDER KH SERIES FLOW AND DIFFERENTIAL PRESSURE METERS. George Kent Ltd., Luton, Beds.

Specification sheet SS 011 illustrates and describes these bell-operated low-head meter/recorder instruments giving full details including dimensions and mounting details.

* * *

Instrumentation for world s largest continuous sugar diffuser.— The largest continuous sugar diffuser in the world, of 6·75 metres internal diameter and processing over 4000 tons of beet daily, has been equipped with instrumentation to provide fully automatic working. Some 120 ft long, and manufactured by Duncan Stewart & Co. Ltd., the diffuser is at the Ely factory of the British Sugar Corporation. Honeywell Controls Ltd.



have supplied the main instrumentation which consists of miniature and full-size indicating and recording controllers on a semi-graphic panel. Diffusion water flow is continuously linked to the controlled weight of beet slices entering. There is an overriding control of slice weight and diffuser speed from a controller linked to circulation tank level. Other quantities controlled by Honeywell instruments are: pre-lime tank level, raw juice flow and temperature, circulation juice temperature, and pH. Four Cambridge recorders give permanent records of raw and circulation juice temperatures, and temperatures of the heat exchanger and diffusion water heater. To the right of the panel are auto/manual contactors and Record Electrical tachometers for beet slicer speeds.

* * *

Continuous centrifugals licence. Watson Laidlaw & Co. Ltd. have concluded an agreement with Hein, Lehmann & Co. A.G. whereby they will manufacture their well-known continuous-flow centrifugal.

Per Caput Consumption of Centrifugal Sugar [1]

(kg, raw value)

EUROPE	1958	1959	1960
Albania	8·6	8·7	9·1
Austria	39·3	40·2	40·1
Belgium/Luxembourg	36·8	33·4	36·7
Bulgaria	17·5	17·9	18·4
Czechoslovakia	38·1	38·8	38·5
Denmark	58·8	57·4	59·5
Finland	45·2	43·4	43·3
France	33·9	32·5	32·4
Germany, East	32·7	32·7	32·6
Germany, West	31·7	30·1	32·0
Greece	12·2	12·7	12·9
Hungary	33·9	28·1	30·1
Iceland	60·9	61·8	61·6
Ireland	55·6	55·5	57·1
Italy	20·7	19·9	21·8
Netherlands	54·4	55·3	59·7
Norway	42·4	42·0	43·4
Poland	31·7	31·4	30·2
Portugal	16·2	18·2	17·9
Roumania	12·2	13·1	13·5
Spain	16·7	16·7	17·1
Sweden	46·7	44·5	46·1
Switzerland	52·5	43·4	46·7
Turkey	12·6	11·5	11·7
United Kingdom	51·4	55·3	55·3
U.S.S.R.	26·3	27·8	29·7
Yugoslavia	13·8	16·9	18·8
NORTH AMERICA			
Canada	47·1	46·6	46·7
Greenland	67·9	67·9	69·0
United States	47·5	47·5	47·0
CENTRAL AMERICA			
Bahamas	31·6	41·7	42·9
Bermuda	51·2	50·0	51·1
British Honduras	22·6	25·1	23·8
Costa Rica	31·7	32·3	31·8
Cuba	37·4	50·2	51·8
Dominican Republic	25·4	27·0	26·0
El Salvador	14·9	15·9	16·5
Guadeloupe	16·7	17·8	18·6
Guatemala	17·3	17·8	18·5
Haiti	11·1	10·0	9·6
Honduras	11·7	12·0	13·0
Martinique	17·0	21·3	21·3
Mexico	31·4	31·9	32·6
Netherlands Antilles	36·3	36·5	35·8
Nicaragua	22·5	25·5	25·5
Panama	18·1	18·9	19·5
Puerto Rico	42·0	42·9	42·8
West Indies Federation	37·0	37·0	35·9
SOUTH AMERICA			
Argentina	39·7	38·1	33·4
Bolivia	17·7	19·8	16·0
Brazil	35·9	34·7	37·7
British Guiana	35·9	35·9	36·8
Chile	31·4	30·0	33·4
Colombia	21·6	20·5	20·4
Ecuador	18·8	19·1	19·7
French Guiana	23·3	23·3	25·8
Paraguay	12·2	12·4	8·7
Peru	23·5	23·1	23·2
Surinam	25·7	25·4	26·7
Uruguay	42·6	41·2	41·6
Venezuela	23·5	27·1	33·8
ASIA			
Afghanistan	1·8	1·8	2·0
Burma	4·0	3·5	3·5
Cambodia	1·5	1·6	1·7
Ceylon	20·2	20·9	21·4
China, Mainland	1·5	1·9	2·4

ASIA—*continued*	1958	1959	1960
Hong Kong	21·8	19·1	21·5
India	5·8	5·7	5·5
Indonesia	8·1	8·1	7·8
Iran	17·4	18·7	18·7
Iraq	28·8	27·0	27·3
Israel	28·6	38·9	37·7
Japan	13·8	14·3	15·1
Jordan	25·3	27·5	23·9
Korea, North	1·3	1·5	1·6
Korea, South	2·8	2·8	3·0
Laos	1·1	1·2	1·1
Lebanon	15·6	14·5	16·9
Malaya Federation	26·1	26·0	25·9
Mongolia	1·3	1·5	1·6
Nepal	0·2	0·3	0·3
Pakistan	2·6	2·3	2·3
Philippines	13·4	12·0	11·4
Syria	14·0	14·8	14·4
Taiwan	12·1	11·4	11·0
Thailand	4·0	4·6	5·4
Vietnam	1·2	1·5	2·0
AFRICA			
Algeria	21·4	21·0	24·8
Angola	5·3	5·3	5·4
(Belgian) Congo and Ruanda-Urundi	1·4	1·9	1·8
British East Africa:			
Kenya, Uganda & Tanganyika	7·8	8·7	9·4
Zanzibar & Pemba	20·0	19·1	19·5
Egypt	13·8	13·7	14·1
Ethiopia	1·7	1·7	1·8
(French) Equatorial Africa	2·1	2·4	2·5
French Somaliland	47·8	52·1	52·0
(French) West Africa	5·4	5·6	5·6
Gambia	10·0	10·2	10·8
Ghana	8·3	10·2	10·8
Liberia	1·1	1·2	1·3
Libya	16·5	16·8	17·4
Madagascar	4·5	4·8	5·0
Mauritius	40·1	39·1	40·9
Morocco	31·5	30·8	31·6
Mozambique	6·2	7·0	7·5
Nigeria	1·8	1·9	2·0
Réunion	21·7	24·5	25·1
Rhodesian Federation	9·3	9·4	9·8
Sierra Leone	4·0	4·6	4·9
Somaliland (ex-British)	15·4	14·3	14·9
(ex-Italian)	8·7	9·7	9·9
South Africa	47·4	47·4	46·1
Spanish North Africa	24·8	25·3	26·0
Sudan	11·3	11·0	10·8
Tunisia	21·3	21·7	21·8
OCEANIA			
Australia	57·3	56·3	55·1
Fiji	39·1	45·3	34·3
French Oceania	40·5	43·7	44·8
Gilbert & Ellice Islands	11·4	13·3	13·0
Hawaii	56·0	55·4	56·0
New Hebrides	12·0	14·4	14·7
New Zealand	51·3	47·0	51·3
Solomon Islands	4·8	5·2	5·1
U.S. Administrated Oceania	23·8	24·9	24·8
Western Samoa	24·5	24·0	24·5
West New Guinea	3·4	3·7	4·0
WORLD AVERAGE	15·8	15·9	16·3

[1] Taken from Sugar Year Book, 1960 (International Sugar Council, London). 1961.

BREVITIES

Erratum.—At the bottom of the left hand column of page 100 in our April 1961 issue, the cost of application of trash or bagasse in the soil was given as $30–$40 per ton. This should have read $30–$40 per acre.

* * *

The late J. F. Abbott.—Joseph F. Abbott, retired Chairman of the Board and former President of The American Sugar Refining Company, died at his home on the 9th November after a long illness. He was 73 years old. Mr. Abbott was a prominent figure in the sugar business for many years. He became President of American Sugar in 1929 and served as its President or Chairman for 28 years. He was instrumental in the formation of, and served as the first President of, the Sugar Research Foundation Inc., the non-profit organization established to conduct research on sugar utilization and by-products and distribute factual information about sugar in the human diet.

* * *

Rhodesia and the Commonwealth Sugar Agreement.[1]—The Chairman of the Rhodesia Sugar Refinery Ltd., Col. B. N. ADAMS, stated recently that the Rhodesian sugar industry would apply for an export quota to Britain under the Commonwealth Sugar Agreement when representatives of Commonwealth sugar exporters met in London later this year for their annual discussions with the U.K. Government. Talks were going on between the refinery and the three sugar growing interests at Triangle, Chirundu and Hippo Valley which were expected to lead to the formation of a federal sugar association.

Stock Exchange Quotations

London Stocks (*at 17th November*, 1961)	CLOSING MIDDLE
Anglo-Ceylon (5s)	11/8¼
Antigua Sugar Factory (£1)	5/–
Booker Bros. (10s)	22/7½
British Sugar Corp. Ltd. (£1)	23/9
Caroni Ord. (2s)	4/7½
Caroni 6% Cum. Pref. (£1)	12/
Distillers Co. Ltd. (10s units)	39/6
Gledhow Chaka's Kraal (£1)	30/–
Hulett & Sons (R1)	11/
Jamaica Sugar Estates Ltd. (5s units)	3/9
Leach's Argentine (10s units)	27/3
Manbré & Garton Ltd. (10s)	41/6
Reynolds Bros. (£1)	28/6
St. Kitts (London) Ltd. (£1)	14/–
Ste. Madeleine (Ord.) (£1)	28/6
Sena Sugar Estates Ltd. (10s)	8/6
Tate & Lyle Ltd. (£1)	48/6
Trinidad Sugar (5s stock units)	34/6
United Molasses (10s stock units)	31/–
West Indies Sugar Co. Ltd. (£1)	15/9

New York Stocks (*at 16th November*, 1961)	CLOSING MIDDLE $
American Crystal ($10)	48
Amer. Sugar Ref. Co. ($25)	33¾
Central Aguirre ($5)	24⅜
Cuban American ($10)	16¼
Great Western Sugar Co.	32¾
South P.R. Sugar Co.	24⅛
United Fruit Co.	25⅛

Paraguay and the I.S.A.[2]—Paraguay has now joined the International Sugar Agreement and the Government was to have ratified the corresponding Act by the end of September.

* * *

Drought in Turkey.[3]—Drought is reported to have seriously affected the sugar beet in Turkey recently and in some areas it seems unlikely that yield will exceed 7 or 8 tons of beet per acre.

* * *

Corrigenda.—In the article on heat transfer in evaporators which appeared in our May 1961 issue, the ordinates of Figs. 1 and 2 are, in fact, values of $R \times 10^6$ and not of R. The values calculated from factory data and condensate measurements on page 142 are of $R \times 10^3$ and not of R as stated.

* * *

Bagasse paper possibilities in Uganda.[4]—Investigations are being carried out on the possiblity of a paper manufacturing industry in Uganda. The suggested site is at Jinja, where timber could be brought from areas in both Uganda and Kenya, and which is also centrally situated in relation to the two sugar factories where supplies of bagasse could be obtained.

* * *

Burma sugar factory plans[5].—The Burma Economic Development Corporation plans to erect two further factories in order to attain self-sufficiency in sugar. The first will be located either at Kyaukse, south of Mandalay, or in the district of Prome on the Lower Irrawaddy, while the second will be built in the Karen State where sugar cane is already planted on about 12,000 acres.

* * *

Bagasse pulp mill in Egypt[6].—A mill for the production of pulp from bagasse, to be located at Edfu in Upper Egypt, is to start operations in September 1963. It is to be financed by the U.S. Development Loan Fund and will produce 18,000 tons a year at first and double this quantity shortly afterwards. The unbleached bagasse pulp will be sent for conversion to a kraft paper factory at Suez and to the Rakta factory making printing and writing paper near Alexandria.

* * *

Greek ban on Cuban sugar.[7]—An embargo has been placed on imports of Cuban sugar into Greece through all bilateral clearing countries except Egypt. Practically all consignments of sugar imported into Greece over the last year or so represented re-exports of Cuban sugar by Eastern bloc countries; these will no longer be possible under the new regulations. Greek traders believe that the exception in favour of Egypt was made owing to that country's regular trade deficit with Greece.

* * *

Drought in Hawaii[8].—It is reported by the Hawaiian Sugar Planters' Association that a drought on the Hamakua Coast and in Kau continues to be "very serious" with damage greatest to the 1962 and 1963 crops. Some effect is being felt in the 1961 crop but this is not considered as serious. At Honokaa plantation, harvesting and saving its 1962 crop was expected to get underway on the 8th September 1961, while in Kau, some 600 acres of the 1962 crop had already been harvested to save it before it died. On some plantations on the island of Hawaii dry weather has resulted in good harvesting but this is the third year of dry weather in the zones and the worst of the three droughts.

[1] *Commonwealth Producer*, 1961, (385), 180.
[2] F. O. Licht, *International Sugar Rpt.*, 1961, **93**, (8), 135.
[3] C. Czarnikow Ltd., *Sugar Review*, 1961, (526), 617.
[4] *Overseas Review* (Barclays D.C.O.), October 1961, p. 41.
[5] F. O. Licht, *International Sugar Rpt.* 1961, **93**, (Supp. 16), 213.
[6] *Foreign Trade*, 1961, 116, (7), 31.
[7] *Public Ledger*, 7th October 1961.
[8] *Willett & Gray*, 1961, **85**, 375.

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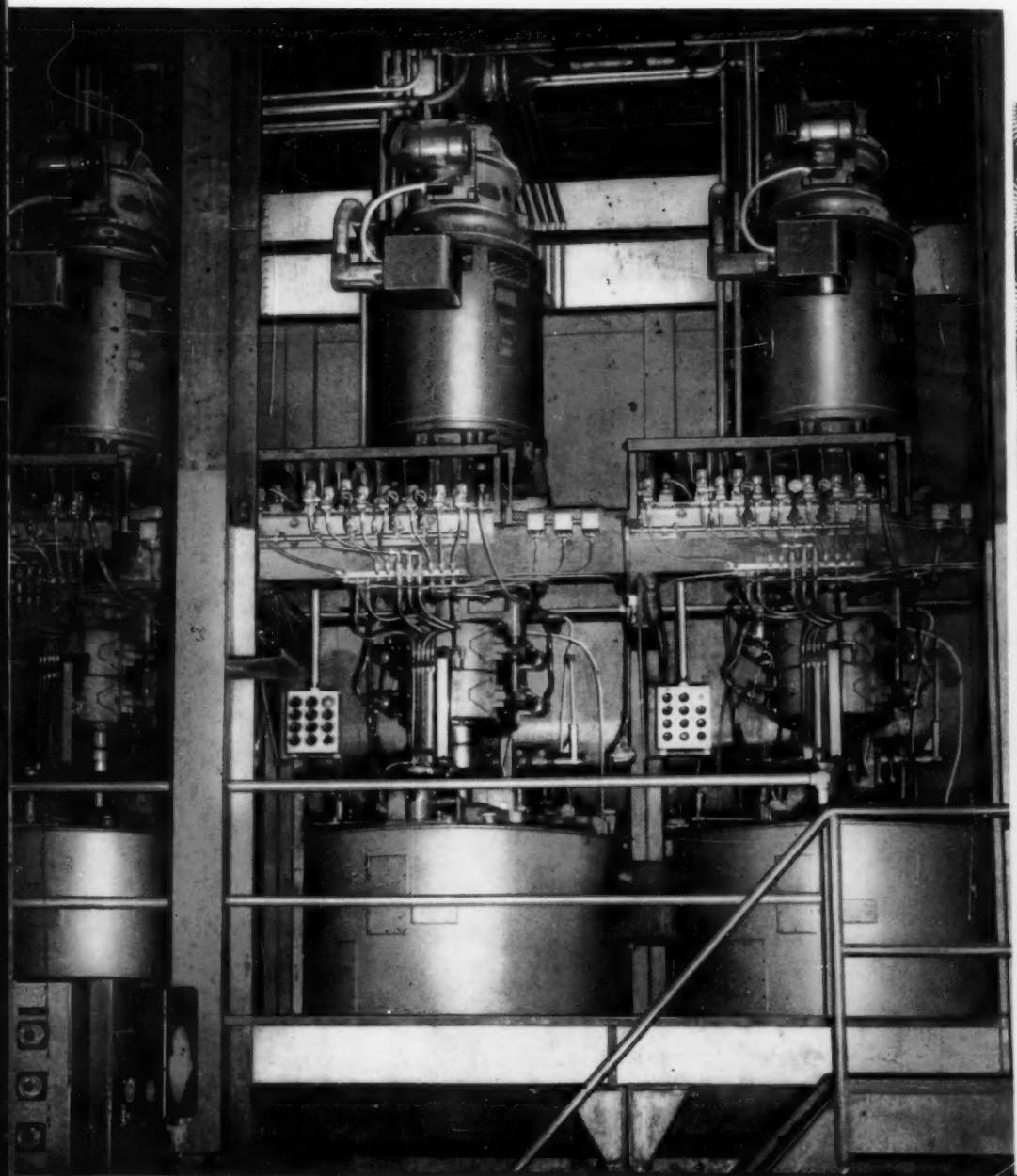

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Index to Advertisers

	PAGE
Blairs Ltd.	Inside Front Cover, xxxi
Thomas Broadbent & Sons Ltd.	i
Buckau R. Wolf A.G.	xxv
Buell Ltd.	lvi
Büttner-Werke A.G.	xli
Cary Iron Works	lviii
Clydesdale Chemical Co. Ltd.	lv
Cochran & Co. Annan, Ltd.	xlii
Cocksedge & Co. Ltd.	v
George Cohen, Sons & Co. Ltd.	xlix
A. F. Craig & Co. Ltd.	xxx
Crofts (Engineers) Ltd.	xxxvi
A/S De danske Sukkerfabrikker	xxvi
Dorr-Oliver Inc.	Inside Back Cover
Electromagnets Ltd.	ii
English Electric Co. Ltd., Plant Sales Divn.	vi
Escher Wyss Ltd.	vii
Ewart Chainbelt Co. Ltd.	liv
Farrel-Birmingham Co. Inc.	x
E. Farrell & Son Ltd.	l
Ferguson Perforating & Wire Co.	lvi
Soc. Fives Lille—Cail	viii
George Fletcher & Co. Ltd.	Outside Back Cover
Fontaine & Co.	liv
Goka N.V. Machinefabriek	xlix
E. Green & Son Ltd.	xxxix
Gruendler Crusher & Pulveriser Co.	ix
Hein, Lehmann & Co. A.G.	xxiii
N. A. Helmer	liv
Interbagasse	xii
Johns-Manville International Corp.	xlvii
Amandus Kahl Nachf.	xlvi
King Aircraft Corporation	lv
Kingston Industrial Works Ltd.	xvii
Kleen-e-ze Brush Co. Ltd.	li
AB. Landsverk	xxxviii, xlviii
Link-Belt Co.	xiii
Locker Industries (Sales) Ltd.	xix
E. C. Masson	liv
Metrimpex, Budapest	xvi
L. S. Miedema Landbouwwerktuigenfabriek N.V.	lvii
Mirrlees Watson Co. Ltd.	iii, xliv
New Conveyor Co. Ltd.	xiv
Norit	xliii
Paterson Engineering Co. Ltd.	xl
Pennine Chainbelt Co. Ltd.	l
Logan Perkins Ltd.	xlix
Pott, Cassels & Williamson Ltd.	xxxiv
Ransomes, Sims & Jefferies Ltd.	xxix
Rotameter Mfg. Co. Ltd.	xx
Sackfilling & Sewing Machine Syndicate Ltd.	iv
Salzgitter Maschinen A.G.	xxi
Sandvik Steel Band Conveyors Ltd.	xxii
Siemen & Hinsch m.b.H.	li
Richard Simon & Sons Ltd.	lvii
A. & W. Smith & Co. Ltd.	xxxii, xxxiii
Duncan Stewart & Co. Ltd.	xxxvii
Stork-Werkspoor N.V.	xi
Sugar Manufacturers' Supply Co. Ltd.	xxxv
Thames Packaging Equipment Co. Ltd.	xlv
Toyo Chemical Engineering Co. Ltd.	xviii
Watson Laidlaw & Co. Ltd.	xxviii
Western States Machine Co.	liii
Joseph Westwood & Co. Ltd.	li
Yorkshire Imperial Metals Ltd.	xv

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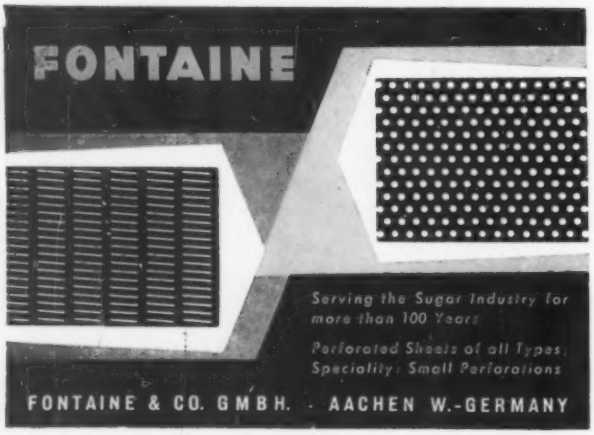
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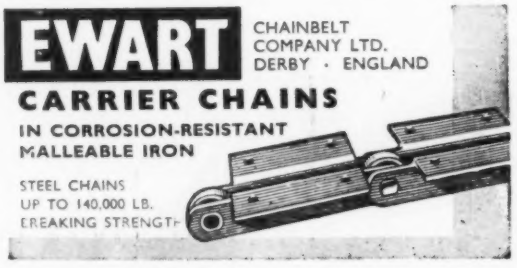

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(*See* page 371)

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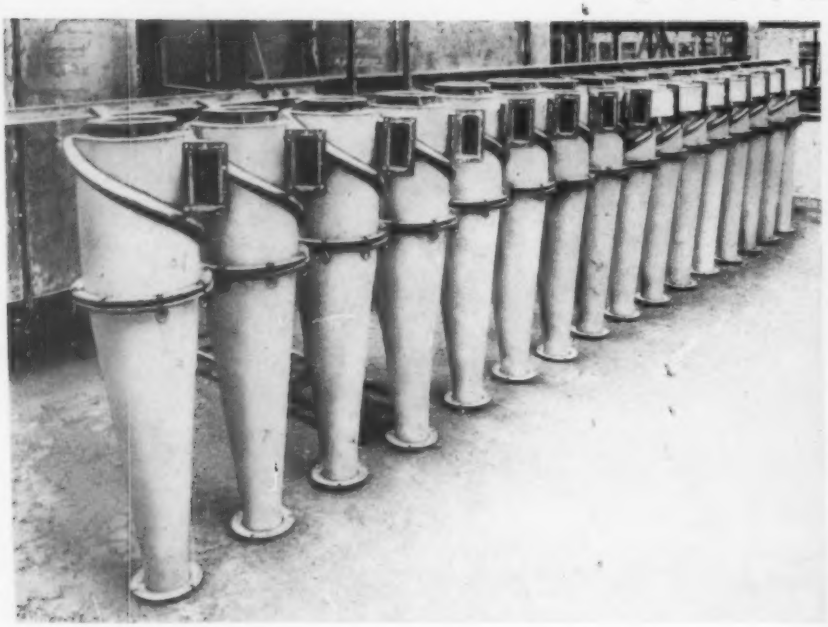

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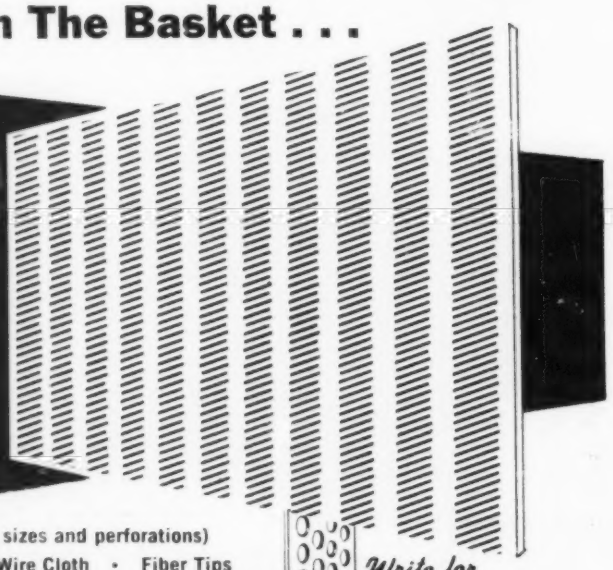

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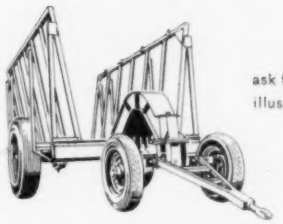

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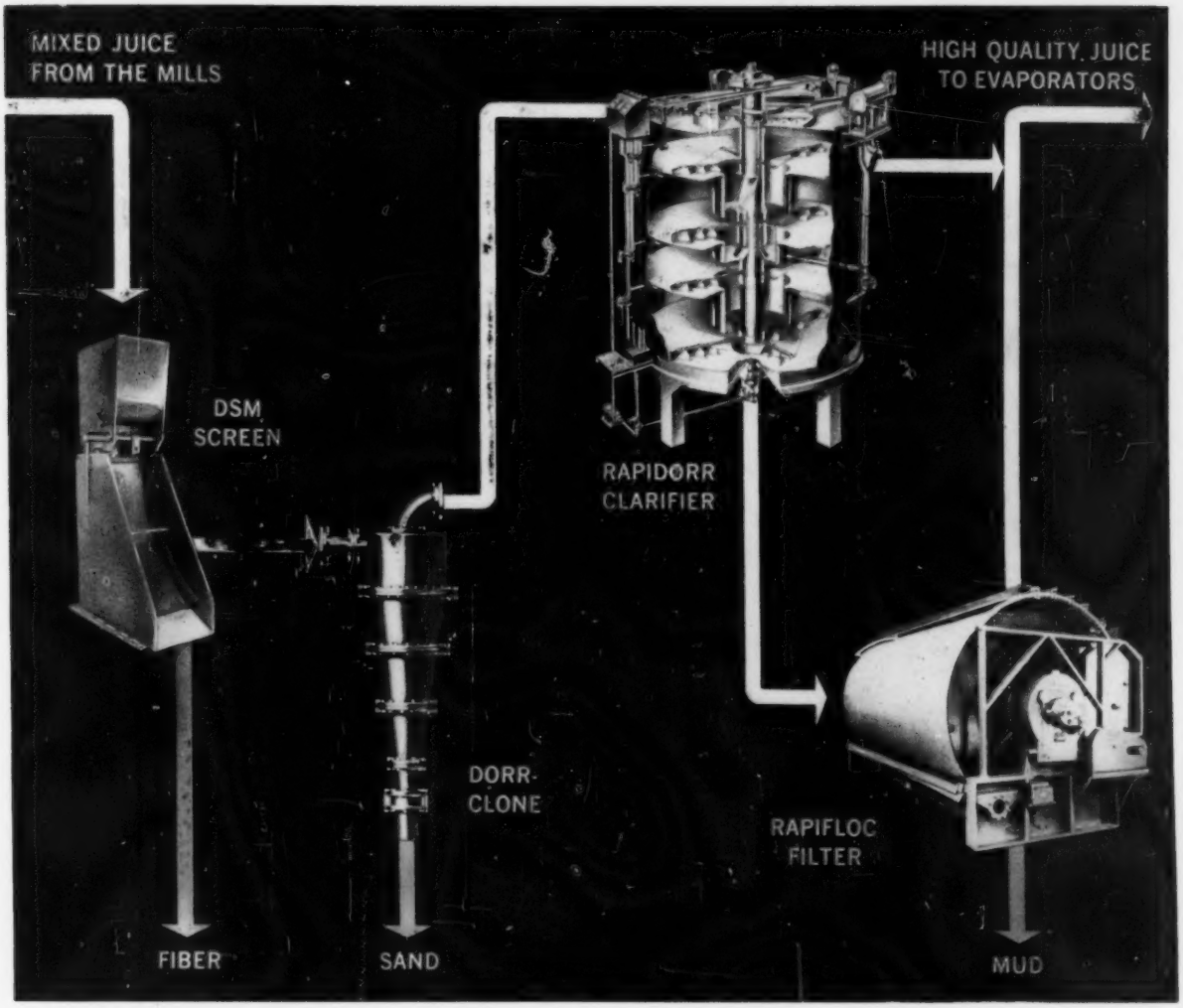

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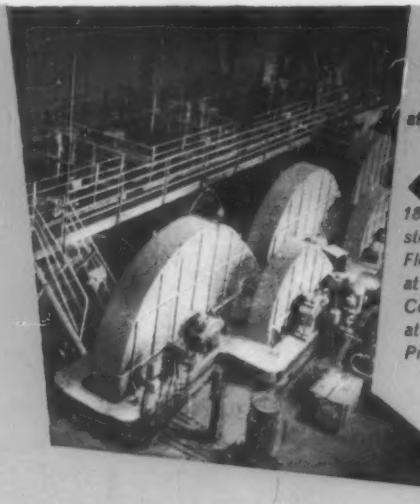

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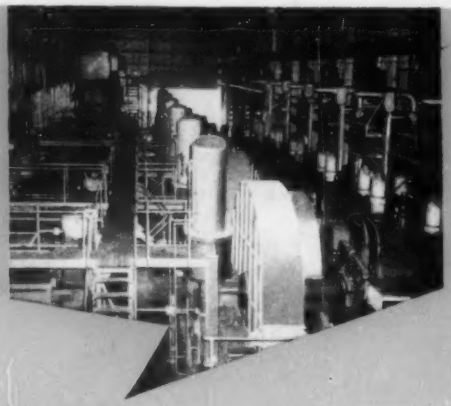

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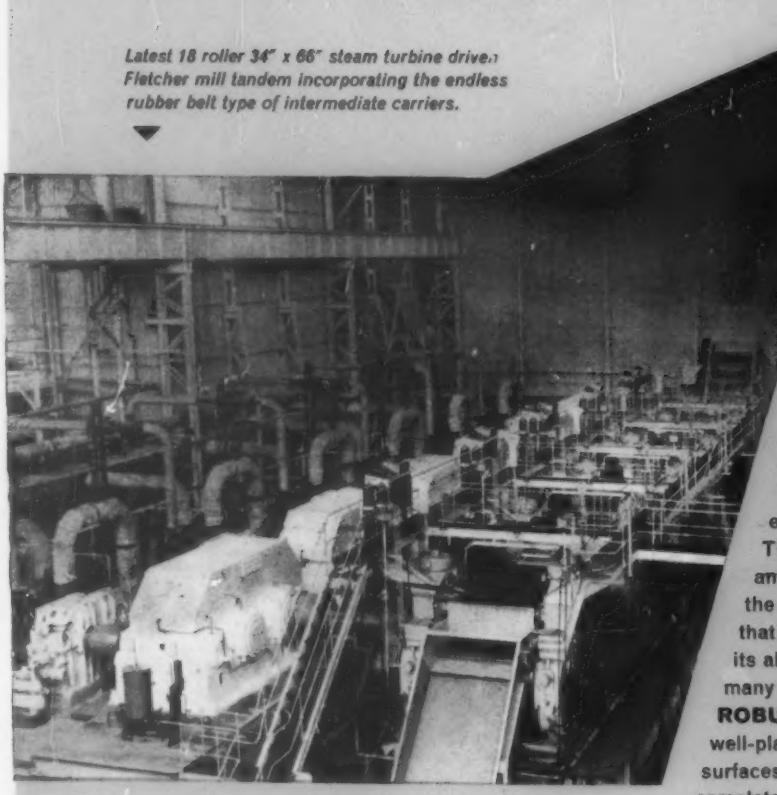

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